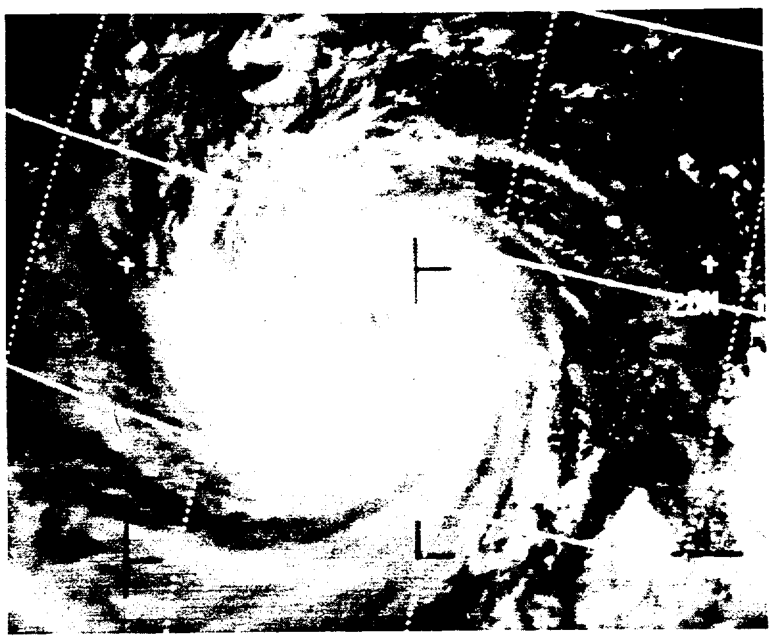
ANNUAL TYPHOON Report



1971

FLEET WEATHER CENTRAL/JOINT TYPHOON WARNING CENTER

Guam, Mariana Islands

SEE EDGE INDEX
ON BACK COVER

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1971
ANNUAL TYPHOON REPORT

FOREWORD

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to the North American Coast, and Annex B summarizes tropical cyclones in the Bay of Bengal east of 90 degrees.

When directed by CINCPAC in May 1959, CINCPACFLT redesignated Fleet Weather Central Guam as Fleet Weather Central/ Joint Typhoon Warning Center (FWC/JTWC), Guam with the following responsibilities:

1. To provide warnings to U. S. Government agencies for all tropical cyclones north of the equator and west of 180 degrees longitude to the coast of Asia and Malay Peninsula.

2. To determine tropical cyclone reconnaissance requirements and assign priorities.

3. To conduct investigative and post-analysis programs including preparation of the Annual Typhoon Report.

4. To conduct tropical cyclone forecasting and detection research as practicable.

Air Force Asian Weather Central at Fuchu, coordinating with U. S. Navy Fleet Weather Facility Yokosuka, was designated as alternate JTWC in case of failure of FWC/JTWC Guam. Naval Weather Service Environmental Detachment, Yokosuka has replaced Fleet Weather Facility Yokosuka in this coordinating role.

The JTWC is an integral part of FWC/JTWC Guam and is authorized to be manned by three officers and five enlisted men from each the Navy and Air Force. The senior Air Force officer is designated as Director, JTWC.

The Western Pacific Tropical Cyclone Warning System consists of the Joint Typhoon Warning Center, the U. S. Air Force 54th Weather Reconnaissance Squadron stationed at Andersen Air Force Base, Guam, and U. S. Navy Airborne Early Warning Squadron ONE stationed at Naval Air Station, Agana, Guam. Fleet Air Reconnaissance Squadron ONE absorbed Airborne Early Warning Squadron ONE on July 1, 1971 and the cyclone reconnaissance mission was discontinued on November 1, 1971.

The Central Pacific Hurricane Center (CPHC), Honolulu is responsible for the area from 180° eastward to 140°W and north of the equator. Warnings are issued in coordination with the FLEWEACEN Pearl Harbor and the Air Force Central Pacific Forecast Center, Hickam Air Force Base, Hawaii.

The Eastern Pacific Hurricane Center (EPHC), San Francisco is responsible for the area east of 140°N and north of the equator. Warnings are issued in coordination with the FLEWEACEN Alameda and the Air Force Hurricane Liaison Officer, McClellan Air Force Base, California.

The coordinating agencies under CINCPACFLT and CINCPACAF are responsible for further dissemination and, if necessary, local modification of tropical cyclone warnings to U. S. military agencies.

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CHAPTER 1

OPERATIONAL PROCEDURES

A. GENERAL

Services provided by the Joint Typhoon Warning Center (JTWC) include forecasts of tropical cyclone formation, intensity, direction and speed of movement and area extent of damaging winds. The primary products of JTWC providing these services are the Tropical Cyclone Formation Alert issued when formation of a tropical cyclone is suspect, and tropical cyclone warnings issued in 1971 at 0000Z plus every six hours whenever significant tropical cyclones were observed in the JTWC area.

FLEWEACEN Guam provides computer and meteorological/ oceanographic synoptic scale analysis support for JTWC.

Communications services for JTWC are provided by the Nimitz Hill Message Center of NAVCOMMSTA Guam.

Before October 1971 warnings for typhoons were transmitted using FLASH precedence to forces afloat, a continuation of a policy authorized in late 1970 by CINCPACFLT. After October a new procedure was initiated whereby typhoon warnings and warnings for specifically designated tropical storms were given special handling in the communications system at NAVCOMMSTA Guam. This procedure terminated the requirement for the regular use of FLASH precedence on typhoon warnings.

B. ANALYSES AND DATA SOURCES

1. FWC ANALYSES:

a. Surface polar stereographic projection analysis, Northern Hemisphere, Western Pacific area; 0000Z, 0600Z, 1200Z, and 1800Z.

b. Surface micro-analysis of South China Sea region; 0000Z, 0600Z, 1200Z, and 1800Z.

c. Surface mercator projection analysis, Northern and Southern Hemisphere, Western Pacific and Indian Ocean area; 0600Z and 1800Z.

d. Sea surface temperature charts; daily.

2. JTWC ANALYSES:

a. Gradient level (3,000 feet) streamline analysis and nephanalysis of satellite-observed significant cloudiness; 0000Z and 1200Z.

b. 700 MB, 500 MB, and 200 MB mercator projection contour analysis; 0000Z and 1200Z.

c. Reconnaissance data. Observations from weather reconnaissance aircraft are plotted on large scale sectional charts.

d. Time cross sections of selected tropical stations.

e. Time sections of surface reports for selected tropical stations.

f. Additional and more frequent analyses similar to those above during periods of tropical cyclone activity.

3. SATELLITE DATA:

Satellite data played a major role in the early detection of tropical cyclones in 1971. This aspect, as well as applications of satellite data to tropical cyclone tracking, is discussed in Chapter 2, Reconnaissance.

4. RADAR:

Land radar reports, when available, were used for tracking tropical cyclones during the 1971 typhoon season. Once a storm moved within range of a land radar site, reports were usually received hourly.

The 1970 Annual Typhoon Report (FWC/JTWC) describes the WESTPAC radar network and use of radar during 1971 is treated in Chapter 2, Reconnaissance.

5. COMPUTER PRODUCTS:

During 1971 the FWC computer was equipped with a varian plotter. After local development of software the varian plotter was used to eliminate a significant portion of the hand plotting effort. Varian charts are plotted routinely at synoptic times for the surface and the 700 and 500 MB levels. Additionally, a chart which approximates the 200 MB level is also plotted. This chart uses rawinsonde data at 200 MBs and composites aireps above 33,000 feet and within six hours of the 0000Z and 1200Z synoptic times. Additional data is added to these charts; data which is not available in the proper format for varian use. These include pibal gradient level winds, low cloud movement, and missing or late synoptic reports necessary for a detailed gradient level streamline analyses.

In addition, the standard array of synoptic scale computer analyses and prognostic charts are provided.

JTWC relies heavily on the computer center for objective typhoon forecasts and for statistical post analysis.

C. FORECAST AIDS

1. CLIMATOLOGY:

The following climatological publications were utilized:

a. Tropical Cyclones in the Western Pacific and China Sea Area (Royal Observatory, Hong Kong), covering 70 years of typhoon tracks.

b. Intensity Changes of Tropical Storms and Typhoons of the Western North Pacific Ocean (Brand and Gaya, 1971) NAVWEARSCHFAC Tech Paper No. 5-71.

c. Climatological 24-Hour Typhoon Movement (McCabe, J. T., 1961).

d. Western Pacific Typhoon Tracks, 1950-1959 (FWC/JTWC).

e. Far East Climate Atlas (1st Weather Wing, February 1963).

f. Annual Typhoon Reports, 1959-1969 (FWC/JTWC).

g. A Climatology of Tropical Cyclones and Disturbances of the Western Pacific with a Suggested Theory for Their Genesis/Maintenance (Gray, Wm., 1970) NAVWEARSCHFAC Tech Paper No. 19-70.

h. The Typhoon Analog computer program (TYFOON).

2. PERSISTENCE:

Extrapolation of storm movement using 12 hour mean speed and direction was the most reliable objective method for 24 hour forecasts.

3. OBJECTIVE TECHNIQUES:

During 1970 the following individual objective forecasting methods were employed:

a. ARAKAWA - surface pressure grid model.

b. HATRACK - based on 700 MB SR prognosis.

c. HATRACK - based on 500 MB SR prognosis.

d. TYRACK - based on program-selected best steering level from Pearl tropical fields.

e. TYFOON - analog weighted mean track.

(See Chapter 3 for technique evaluation.)

D. FORECASTING PROCEDURES:

1. TRACK FORECASTING: An initial track based on persistence blended subjectively with climatology is developed for a 3 to 4 day period. This initial track is subjectively modified by use of the following:

a. Recent steering is evaluated by considering the latest upper air analyses as representative of the average upper air flow over the past 24 hours. (The latest upper air analyses are normally about 12 hours old, thus roughly represent the mid-point of the last 24 hour time interval.) By this technique actual past 24 hour movement serves to indicate the best steering level as well as the effectiveness of steering.

b. Objective techniques are considered, weight is given to techniques according to recent past performance.

c. Twenty-four hour height-change analyses are evaluated for forecast track/speed changes (Hoover, 1957).

d. The prospects of recurvature must be evaluated for all westward moving storms. The basic tools for this evaluation are accurate continuity on mid-latitude troughs and numerical progs to indicate changes in amplitude or movement. Relative position and strength of the subtropical ridge and northward beta force are also important considerations.

e. Finally, a check is made against climatology to ascertain the likelihood of the forecast. If the forecast track is climatologically unusual a reappraisal of the forecast rationale is made and adjustments are made if warranted.

2. INTENSITY FORECASTING: Intensity forecasts are made by using a linear extrapolation of past intensification subjectively tempered with climatology as a first guess.

This first guess is modified considering availability of upper tropospheric evacuation, 850-700 MB temperatures, sea surface temperatures, ans possible terrain. All these considerations are predictions along the forecast track and are additionally dependent on the accuracy of the forecast positions.

E. WARNINGS:

Tropical cyclone warnings are numbered consecutively without regard for upgrading or downgrading of the storm between intensity stages. If warnings are discontinued and the storm again intensifies, warnings are numbered consecutively from the last warning issued. Amended or corrected warnings are given the same number as the warnings they modify. Forecast positions are issued at 0000Z plus every six hours as follows:

Tropical Depressions	12 hr and 24 hr
Typhoons and Tropical Storms	12, 24, and 48 hr (72 hr at 00Z and 12Z only)

Forecast periods are stated with respect to warning time. Thus a 24 hour forecast verifies 26 hours after the aircraft fix data, 30 hours after the latest surface synoptic chart and 30 or 36 hours after the latest upper air charts.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of results from 1971 is presented in Chapter 4.

F. PROGNOSTIC REASONING MESSAGE:

Whenever warnings are being issued, an amplifying message is issued at 00Z and 12Z. This prognostic reasoning message is intended to provide meteorological units with technical and non-technical reasoning appropriate to the behavior of current storms and the logic of the latest JTWC forecasts.

G. TROPICAL WEATHER SUMMARY:

This message is issued daily from May through December and otherwise when significant tropical cyclogenesis is forecast or observed. It is issued at 0600Z and describes the location, intensity and likelihood of development of all tropical low pressure areas and significant cloud masses detected by satellite.

H. TROPICAL CYCLONE FORMATION ALERT:

Alerts are issued when the formation of a tropical cyclone

is considered possible or probable. Alerts are typically used to cover a suspect area before reconnaissance can be conducted and additionally to cover an existing tropical depression of low or unknown development potential. These messages are issued at any time and are valid for up to 24 hours unless cancelled, superseded or extended.

REFERENCE:

Hoover, E. W., Devices for Forecasting Movement of Hurricanes, Manuscript of the U. S. Weather Bureau, Jan. 1957.

CHAPTER 2

RECONNAISSANCE

A. GENERAL

In past typhoon annuals this chapter has traditionally been allotted to aircraft reconnaissance with little or no mention of the other reconnaissance platforms--satellite and land radar. All three platforms have been given individual attention in this report.

The three reconnaissance platforms are considered by JTWC to be complementary tools. Each has unique advantages and disadvantages not common to the other two. For example, the satellite has the capability of observing vast areas simultaneously, providing data which allows the typhoon forecaster to immediately identify suspect disturbances. On the other hand, once a disturbance is located, its precise state of development can only be determined by aircraft penetration. Only the aircraft can reliably locate the outer limits of the 100, 50, and 30-kt wind envelopes. The land radar site is not plagued by navigational or gridding errors like the other platforms but has the disadvantage of not being able to provide quantitative estimates of intensity. The land radar and satellite platforms have the ability to monitor tropical cyclones when they move within restricted areas such as the no-fly area surrounding China. In short, it is desirable to have all three platforms contributing to the overall reconnaissance data-base.

B. AIRCRAFT RECONNAISSANCE

From the standpoint of flexibility, the aircraft is an outstanding reconnaissance tool. As a mobile meteorological platform, it can provide, by direct measurement, data on a storm's periphery and interior. An assessment of the storm's intensity can be derived on penetration by obtaining a central pressure and profile of maximum winds. By conducting profiles thru the storm, the aircraft can provide data for determining the extent of destructive winds. The airborne platform can remain on station for a 6-hour period enabling it to monitor changes in track movement, intensity and radius of damaging winds and providing this information on a timely basis for input into warnings issued by the appropriate warning center.

1. RECONNAISSANCE REQUIREMENTS

During 1971 JTWC reconnaissance requirements for investigations, fixes, and/or synoptic tracks were relayed to the Tropical Cyclone Reconnaissance Coordinator (TCRC) at Andersen AFB each day about 0300Z for the following day's missions. This message included the area for

FIGURE 2-1 WC-130 AIRCRAFT FLOWN BY THE 54th WEATHER RECONNAISSANCE SQUADRON LOCATED AT ANDERSEN AFB, GUAM.

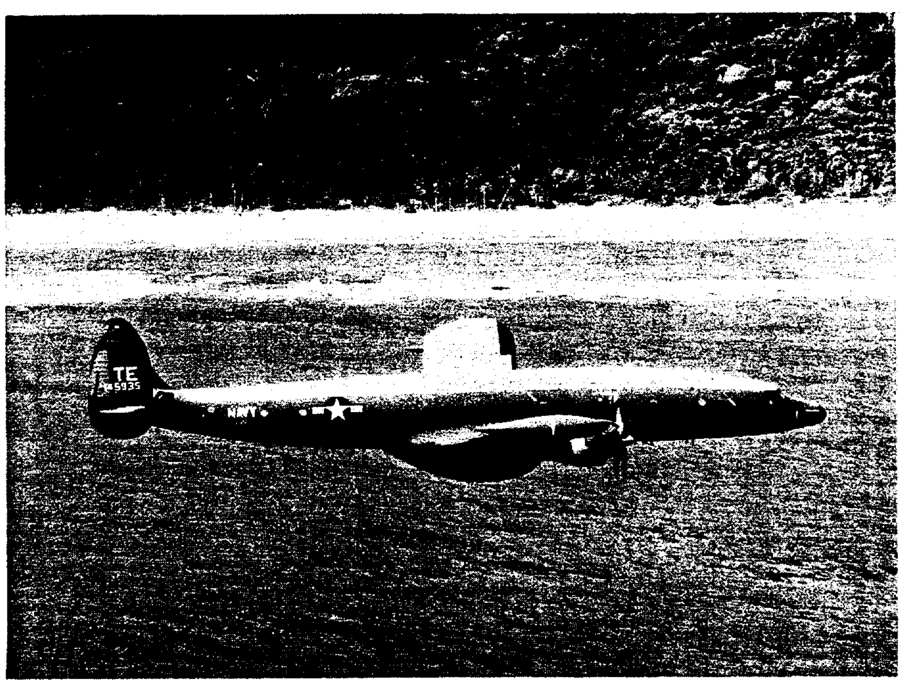

FIGURE 2-2 WC-121 AIRCRAFT FLOWN BY THE FLEET AIR RECONNAISSANCE SQUADRON ONE (VQ-1) LOCATED AT NAVAL AIR STATION, GUAM.

investigation, forecast position of the cyclone at levied fix times, and/or a standard synoptic track. The TCRC then assigned the missions to the Air Force's 54th Weather Reconnaissance Squadron (54 WRS) operating WC-130 aircraft (Figure 2-1) and/or the Navy's Fleet Air Reconnaissance Squadron ONE (VQ-1) operating WC-121 aircraft (Figure 2-2). Both squadrons were based on Guam but often staged from other bases according to the relative location of the reconnaissance area and available assets. Unfortunately, support from VQ-1 was terminated on 1 November due to deactivation of their weather reconnaissance mission. During the peak of the season, aircraft from the 55th and 53rd Weather Reconnaissance Squadrons periodically augmented the assets on Guam.

A change in the levying procedures this past season involved tasking by TCRC of the individual squadrons on the basis of availability of resources, as opposed to the previous fifty-fifty sharing of requirements. A similar system has been in effect for Atlantic hurricane reconnaissance since 1965. Also during 1971 the TCRC, on request from JTWC, provided a crew and aircraft on alert from one of the squadrons for launch within 4 hours, if it was determined that fixes might be levied on a suspect system within the next 24-48 hours. This provided the warning center with increased flexibility in committing reconnaissance assets to a given area. As a result, many investigative flights were canceled based on satellite data just prior to launch of the mission.

Four fixes per day are levied on all tropical cyclones within the JTWC primary area of responsibility (Figure 2-3). Two fixes per day are levied in the secondary area. Reconnaissance aircraft are not allowed to fly within the restricted zone depicted in Figure 2-3. Fixes are levied at six-hourly intervals for two hours before warning time in the primary area and normally at twelve-hourly intervals for three hours before warning time in the secondary area. Additional fixes and other information may be requested by operational commanders through JTWC when such additional information is needed to make operational decisions. These requests are honored as resources permit.

2. INVESTIGATIVE MISSIONS

After detecting a disturbance, by using satellite and conventional data, an aircraft is dispatched to thoroughly investigate the suspect area. Two investigative procedures are used--a point investigative or an investigative pattern. If the disturbance appears to be well

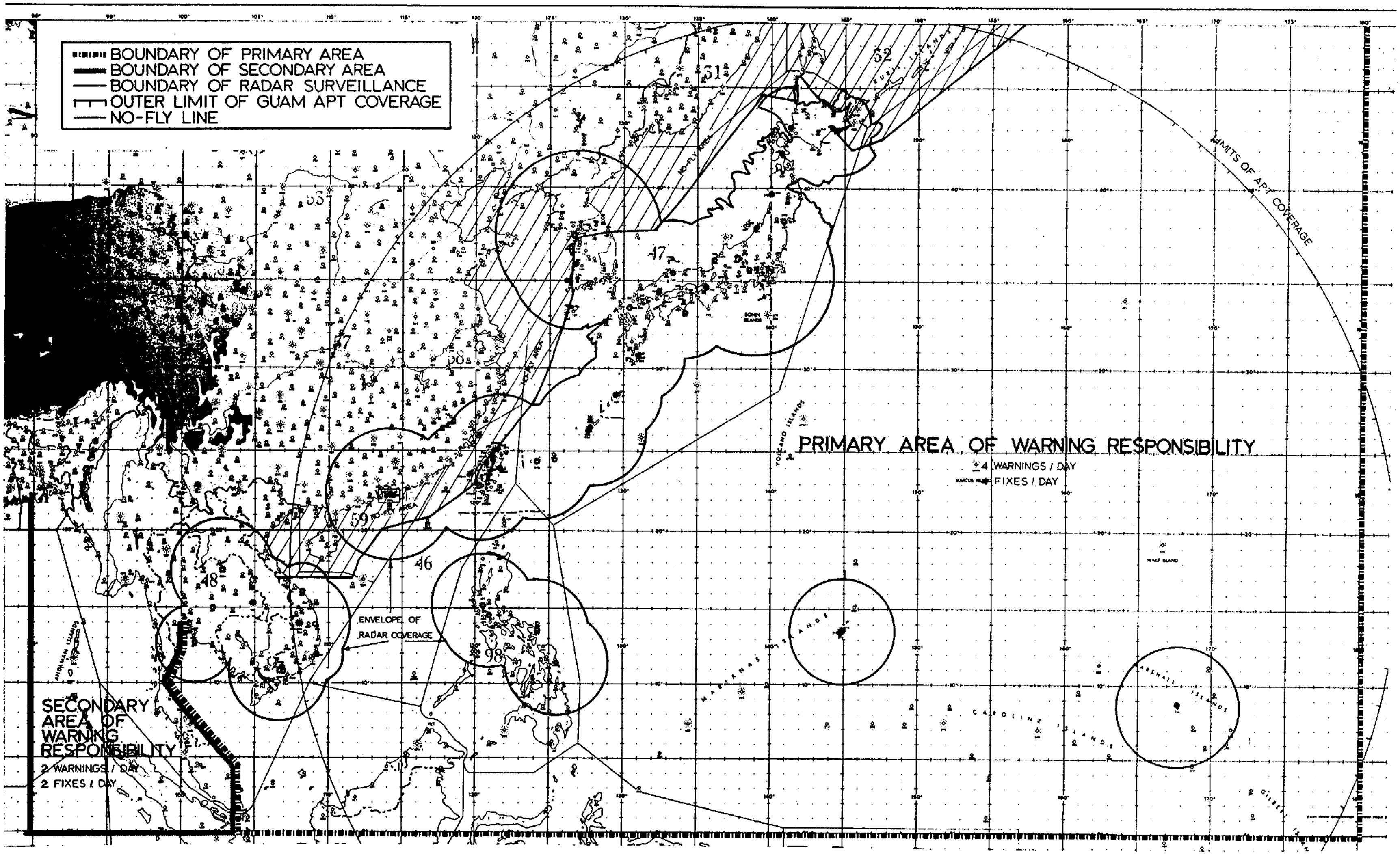

FIGURE 2-3. JOINT TYPHOON WARNING CENTER AREA OF WARNING RESPONSIBILITY. RECONNAISSANCE AIRCRAFT ARE CAPABLE OF FLYING ANYWHERE IN THE AREA EXCEPT THE RESTRICTED ZONE ALONG THE COAST (NO-FLY AREA). LAND RADAR AND SATELLITE COVERAGE ARE OUTLINED FOR REFERENCE.

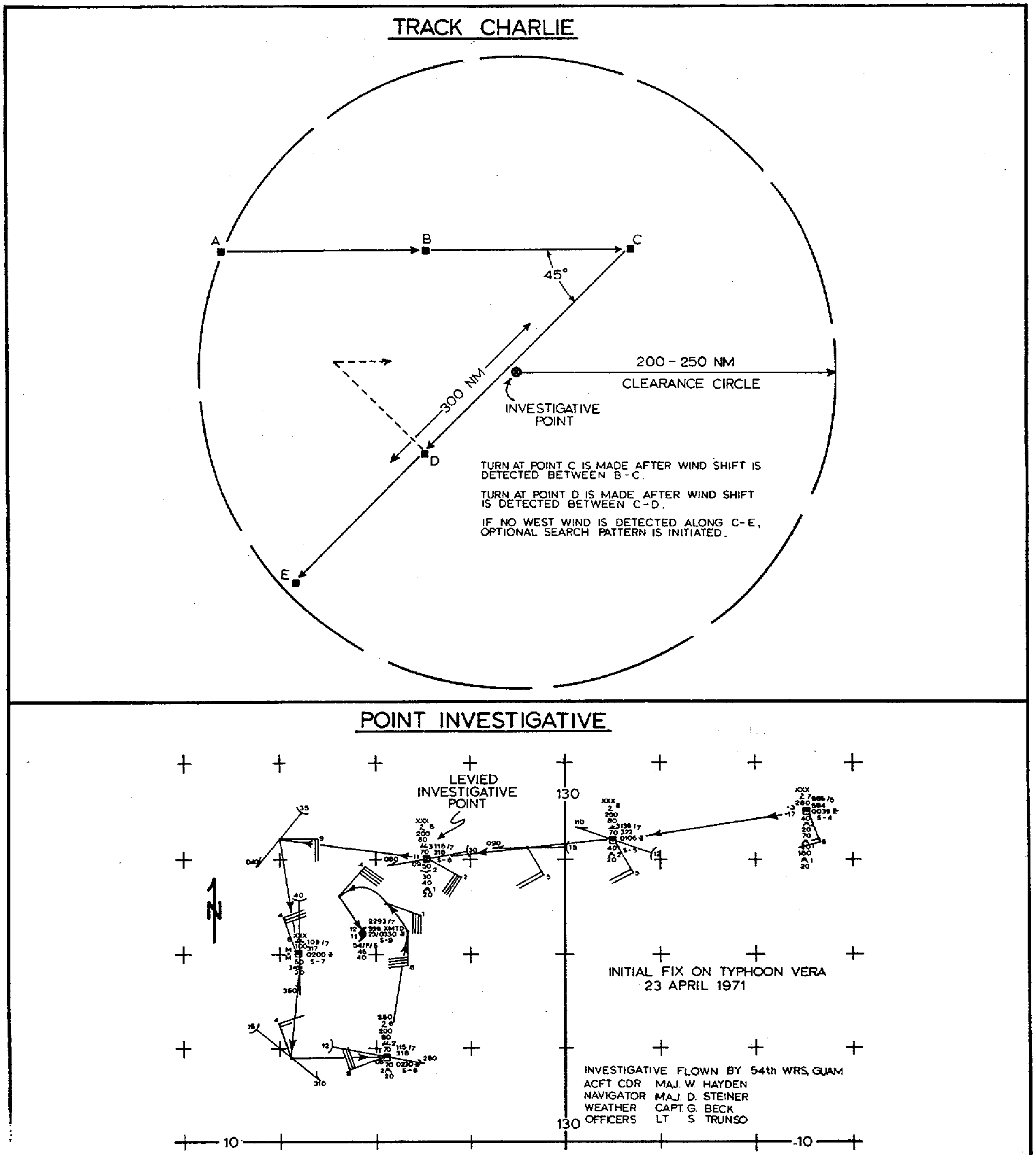

FIGURE 2-4. INVESTIGATIVE TRACK CHARLIE (ABOVE) AND EXAMPLE OF A POINT INVESTIGATIVE (BELOW). CHOICE OF METHOD DEPENDS ON ESTIMATED INTENSITY OF STORM.

developed with little doubt as to the presence of a well-defined circulation, a point investigative is levied. The aircraft flys from the staging base directly to the investigative point and begins a search pattern from there. If the measured wind field and/or radar presentation indicate the levied point is "off", it is up to the meteorologist aboard the aircraft to alter the flight path accordingly in order to fly directly to the center of the disturbance. Figure 2-4 is a good example of a well-executed investigative mission using the point method.

On the other hand, if the precise stage of development is unknown due to the lack of data or the disturbance is obviously not yet well defined, an investigative track is levied (Figure 2-4). This allows the aircraft to fly one latitude degree north of the investigative point until a windshift is detected, then predetermined turns are executed until the circulation is "closed off". The location of the center of circulation (if it exists) is transmitted as soon as available to JTWC. Regardless of the method used, observations are taken and transmitted every 30 minutes with mid-point wind observations in between. Most investigatives are requested to be flown at the 700-mb level (FWC/JTWC, 1970).

3. STORM FIX-MISSIONS

Eye data from tropical cyclones are provided by low-level penetration, intermediate-level penetration, or radar fixes taken from outside the center of the storm. Figure 2-5 shows a radar photograph of a well-developed typhoon taken from the APS-20 scope of the WC-121 aircraft. Some radar fixes are made using the "hole-in-sea-return" as illustrated in Figure 2-6. A discussion of this phenomenon is contained in a report by Senn (1961).

Penetration fixes are preferred since they provide a measure of the storm's intensity. Parameters such as the minimum sea level pressure, minimum geopotential height at standard level, maximum observed wind, and internal temperature of the vortex are used to measure the present intensity of the storm and to identify intensifying or weakening trends. Penetration fixes are made whenever possible but occasionally the small size of the eye combined with the intensity of the winds prohibit penetration. Less than 15% of 1971 fixes were made by radar.

New peripheral tracks were begun in July 1971 (Figure 2-7). These tracks are patterned after those which appear in the National Hurricane Operations Plan. They differ from previous peripheral tracks of past years

FIGURE 2-5 APS-20 RADAR PHOTOGRAPH OF TYPHOON BESS (120 KTS) OVER THE PHILIPPINE SEA 19 SEPTEMBER 1971.

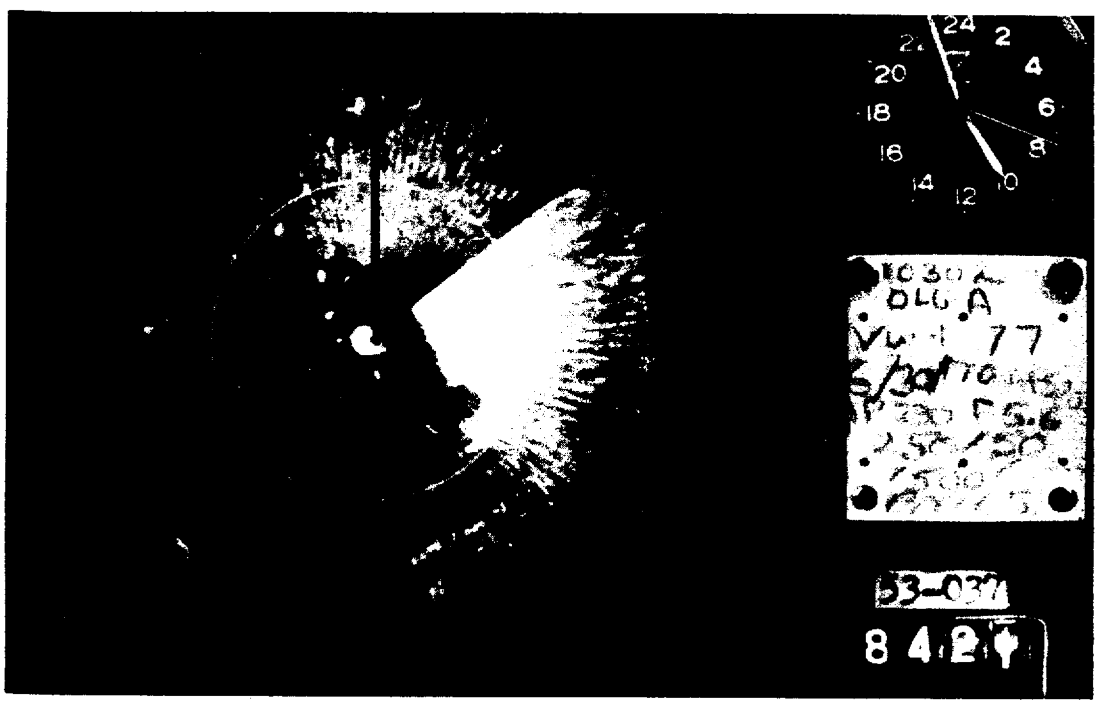

FIGURE 2-6. EXAMPLE OF THE HOLE-IN-SEA-RETURN PHENOMENON WHICH IS USED TO PINPOINT THE CENTER OF THE WIND EYE OF A TROPICAL CYCLONE. THIS APS-20 RADAR PHOTOGRAPH OF TYPHOON OLGA WAS TAKEN 30 JUNE 1970.

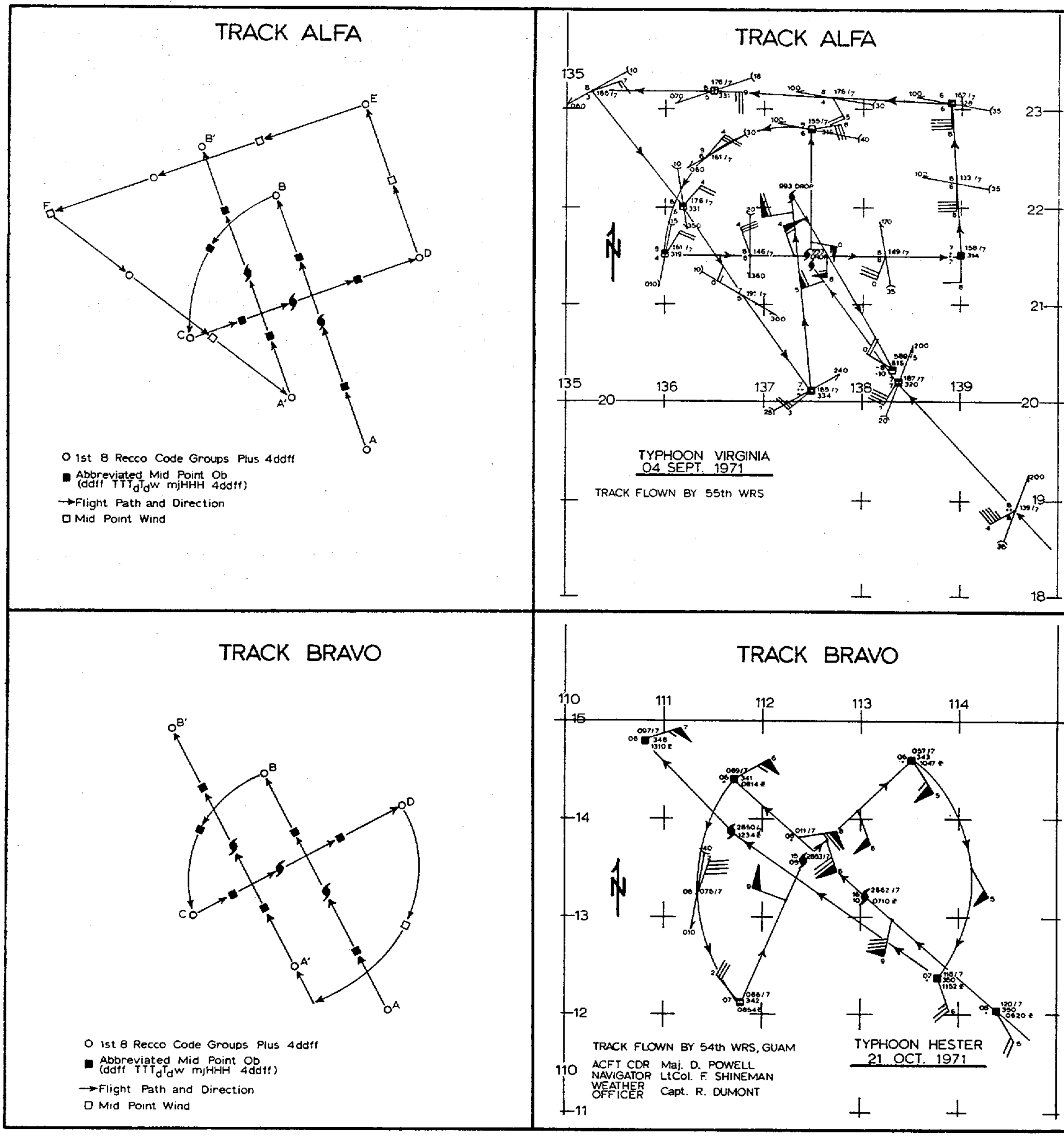

FIGURE 2-7. PERIPHERAL TRACKS FLOWN BY RECONNAISSANCE AIRCRAFT. TRACK ALFA IS USED FOR SIX-HOURLY FIXES AND TRACK BRAVO FOR THREE-HOURLY FIXES.

in that they consist of several radial traverses through the storm center which supply "radial profiles" of parameters such as wind, temperature, and geopotential height. Track ALFA is used for six-hourly fixes and Track BRAVO with three-hourly fixes. JTWC recommends a track to be flown but the ultimate decision as to peripheral track rests with the aircraft commander after arrival on the scene.

4. AIR/GROUND COMMUNICATIONS

The primary method for relay of the eye/center message from the aircraft to JTWC is by means of a direct phone patch with the aircraft. The primary route, as indicated in Figure 2-8, is through the Andersen Aeronautical Station. The weather monitor at Andersen checks the fixes as well as other reconnaissance data for meteorological and technical accuracy and prepares them for transmission to JTWC and on to the Fuchu ADWS for further distribution. If a reliable radio contact cannot be made through Andersen Airways, the message is passed through one of the other designated Aeronautical Stations.

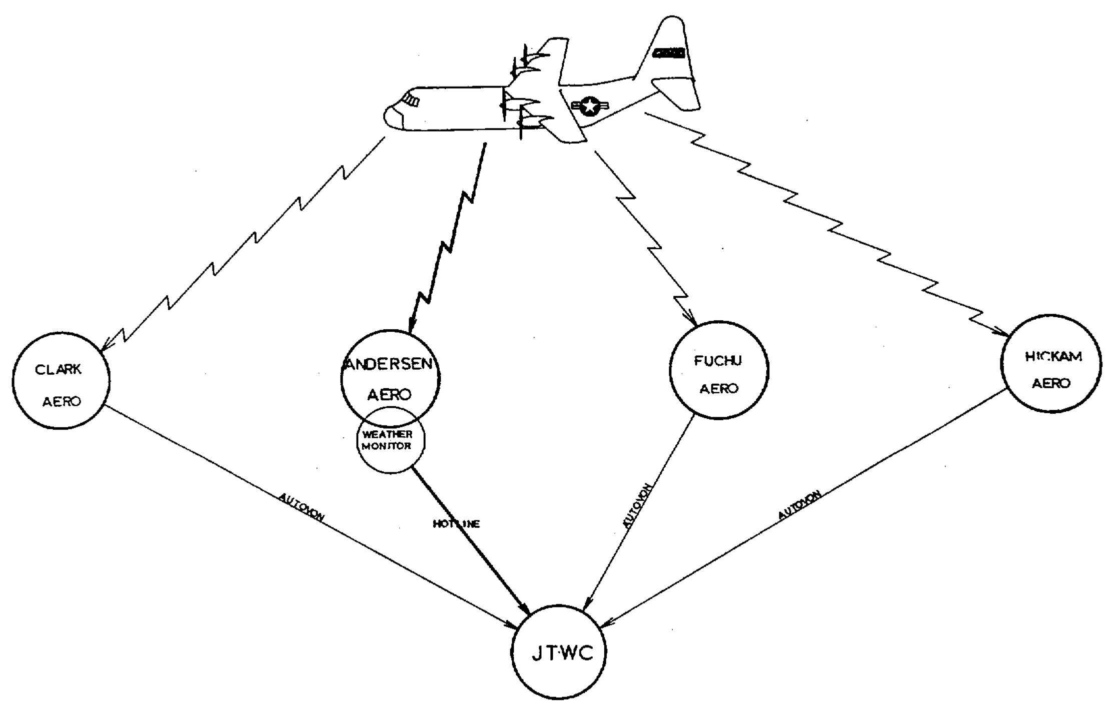

FIGURE 2-8. AIR TO GROUND COMMUNICATION ROUTES. PRIMARY ROUTE IS VIA ANDERSEN AERO.

TABLE 2-1. AVERAGE DELAYS
FOR FIXES RECEIVED DURING 1971 BY METHOD

	AREAS OF RESPONSIBILITY			
	PRIMARY		SECONDARY	
	NO. FIXES	AVERAGE DELAY TIME	NO. FIXES	AVERAGE DELAY TIME
PHONE PATCH	720	27.5 MIN.	3	61.7 MIN.
PHONE RELAY	18	49.7 MIN.	0	
TELETYPE				
A. POINT TO POINT	8	45.9 MIN.	1	135 MIN.
B. AIR TO GROUND	2	32.5 MIN.	0	

AVERAGE DELAY FOR ALL FIXES - 28.7 MIN.

Delay times (defined as the difference between the time of the fix and the time of receipt of the completed message) for receipt of fix data are shown in Table 2-1. Ninety-six percent of all fixes were received by phone patch with an average delay time in the primary area of responsibility of 27.5 minutes and about 62 minutes in the secondary area. Phone relay of fix data (only 2% of total cases) was accomplished if the aircraft's signal was not of patch quality. This method averaged 22 minutes slower than phone patches. Transmission via teletype was also much slower although the number of cases has been kept to about 1% of the total. The two fixes received by the Navy's direct air-to-ground teletype were very early in the season. The average delay for all fixes was 28.7 minutes.

Table 2-2 shows a slight increase in the percent of fixes delayed more than one hour. Here again, the larger number of multiple-storm situations last year than in 1969 or 1970 is a probable explanation due to the inability of the warning center to simultaneously copy two or more eye/center messages. Table 2-2 also shows the percent of fixes received after warning time, the value for this year being just above 2%. Further computations show that 4.5% of all six-hourly fixes arrived in the forecaster's hands less than 30 minutes prior to warning time. The fact that 3.5% of our warnings had to be amended due to non-receipt of fix

TABLE 2-2. 1971 DELAY STATISTICS COMPARED TO PREVIOUS YEARS

	1966	1967	1968	1969	1970	1971
% Fixes Delayed Over One Hour	38%	16%	4%	3%	5%	6%
% Fixes Received After Warning Time	5.4%	3.1%	0.7%	0.6%	0.9%	2.1%

data by release time (normally about 30 minutes before the hour) convincingly demonstrates the importance of these six-hourly fixes in establishing accurate warning positions and intensities.

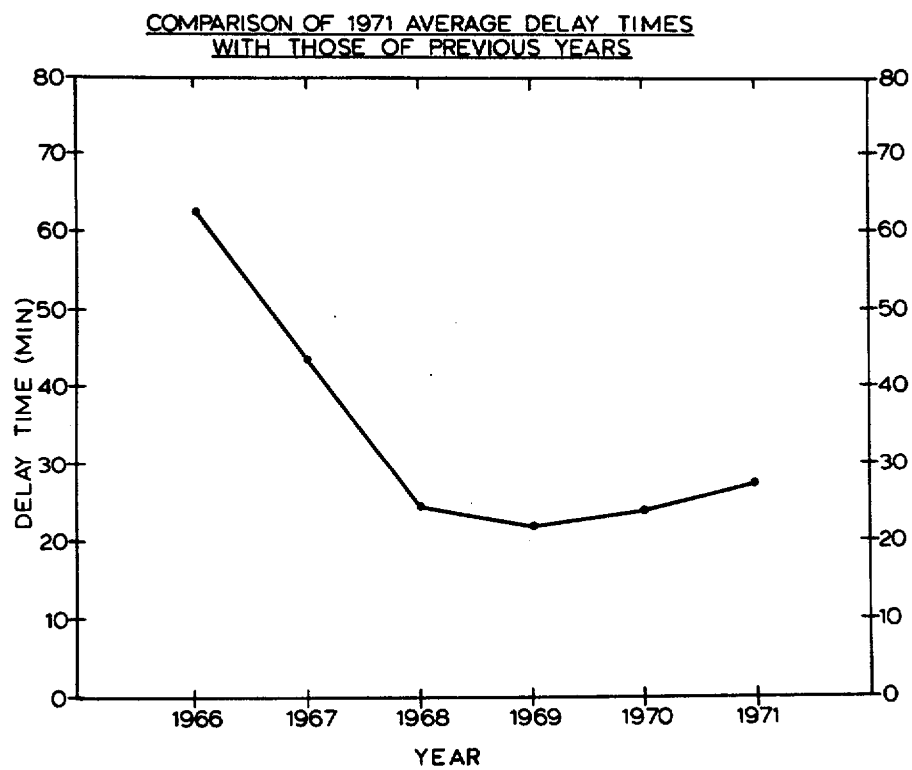

FIGURE 2-9 COMPARISON OF 1971 DELAY TIMES WITH THOSE OF PREVIOUS YEARS.

Figure 2-9 compares average 1971 delay times for all fixes with previous years. During the last three years there has been a slight increase. The greater number of multiple-storm days in 1971 than in 1969 and 1970 could well account for all of the increase.

5. SUMMARY

The extremely active typhoon season last year heavily tasked the available reconnaissance assets. As shown in Table 2-3, the two squadrons were tasked with almost 45% more fixes and investigatives than the long-term average of 675.

TABLE 2-3. COMPARISON OF FIXES AND INVESTIGATIVES LEVIED IN 1971 TO LONG-TERM AVERAGE

Levied Fixes	802
Levied Investigatives	179
TOTAL	981
Average Levied Fixes/Invest (1962-1970)	675

In response to decisions made at the 1971 typhoon conference, the concept of three-hourly fixes was operationally introduced in April. Fixes were levied on a three-hourly basis when tropical cyclones came within 300 n mi of key DOD installations. This amounted to 182 additional fixes being levied or about 23% of the total levied fixes for the year.

TABLE 2-4. DISTRIBUTION OF REQUIREMENTS AMONG RECONNAISSANCE SQUADRONS

	Fixes	Investigatives
54 WRS	58.7%	89%
VQ-1*	41.3%	11%

*Deactivated 1 November 1971.

A. FIXES - TO BE COUNTED AS MADE ON TIME, FIX MUST SATISFY FOLLOWING REQUIREMENTS:

(1) WITHIN 1 HR BEFORE OR NLT 1/2 HR AFTER LEVIED FIX TIME.

(2) RADAR FIX MUST BE WITHIN 75 NM.

(3) FIXES WHICH FALL UNDER CLASS 2 OF OLD SCORING SYSTEM WILL BE COUNTED AS MADE.

(4) LATE/EARLY IS DEFINED AS OUTSIDE TIME FRAME IN A(1) BUT WITHIN 3 HRS (OR WITHIN 1/2 FIX INTERVAL, WHICH-EVER IS LESS) OF LEVIED FIX TIME.

B. INVESTIGATIVES - TO BE COUNTED AS MADE ON TIME, FOLLOWING REQUIREMENTS MUST BE SATISFIED:

(1) IN INVESTIGATIVE CIRCLE BEFORE SPECIFIED NLT TIME.

(2) SPECIFIED FLIGHT LEVEL FLOWN.

(3) FULL RECON OBS EVERY 1/2 HR WITH MID- AND TURN-POINT WINDS REPORTED WHEN INSIDE INVESTIGATIVE CIRCLE.

(4) ADEQUATE COVERAGE ALL QUADS UNLESS CONCENTRATED EFFORT IN ONE OR MORE QUADS HAS BEEN SPECIFIED.

(5) SPECIFIED TRACK FLOWN (IF LEVIED).

(6) CONTACT WARNING CENTER BEFORE TERMINATION.

FIGURE 2-10. CRITERIA FOR EVALUATING RECONNAISSANCE EFFECTIVENESS. ALL FIXES AND INVESTIGATIVES ARE EVALUATED AS MADE ON TIME, LATE, EARLY, OR MISSED.

Of the fixes made, the 54th Weather Reconnaissance Squadron accounted for 59% while VQ-1, or Fleet Air Reconnaissance Squadron ONE, contributed 41% (Table 2-4). This is the same ratio for the number of aircraft which were available for tropical cyclone reconnaissance between the squadrons, however support from VQ-1 was terminated on 1 November due to deactivation of their weather mission. The Air Force squadron, as shown in Table 2-4, was responsible for the majority of the investigative missions.

Aircraft reconnaissance of JTWC's secondary area of responsibility began in October accounting for four levied fixes. The first mission on a Bay of Bengal tropical cyclone occurred on 28 October by an aircraft of the 54th Weather Reconnaissance Squadron operating out of Udorn, Royal Thai Air Base.

6. EFFECTIVENESS

A new scoring method which measures the combined effectiveness of the total reconnaissance force was introduced last season (Figure 2-10). This system is considered simpler and more efficient than its predecessor the "J Factor" which had been in effect since 1965. Another change which occurred last year was the adoption of a hardnose stand on relinquishing levied requirements. Because of the uncertain influence of this change in policy, the statistics of past years are not directly comparable.

TABLE 2-5. RECONNAISSANCE EFFECTIVENESS FOR 1971

	ALL	6HRLY	3HRLY
Completed on Time	698	540	158
Early	6	5	1
Late and Missed	98	75	23
Total Levied	802	620	182

Table 2-5 shows a breakdown of the reconnaissance effectiveness for last season. Of a total of 620 fixes levied for six-hourly intervals, 75 or 12% were late or missed. The late and missed fixes are purposely grouped together since they represent a penalty which is introduced into the typhoon forecast. Late fixes reduce the time available for proper evaluation of the fix and preclude the use of objective techniques. Fixes made after warning time cause a delay in release of a warning or an amendment to the most recent warning. Of course a missed fix degrades the forecast significantly since the initial position is more uncertain. Late and missed fixes affected 10% of the 747 warnings released during the 1971 season.

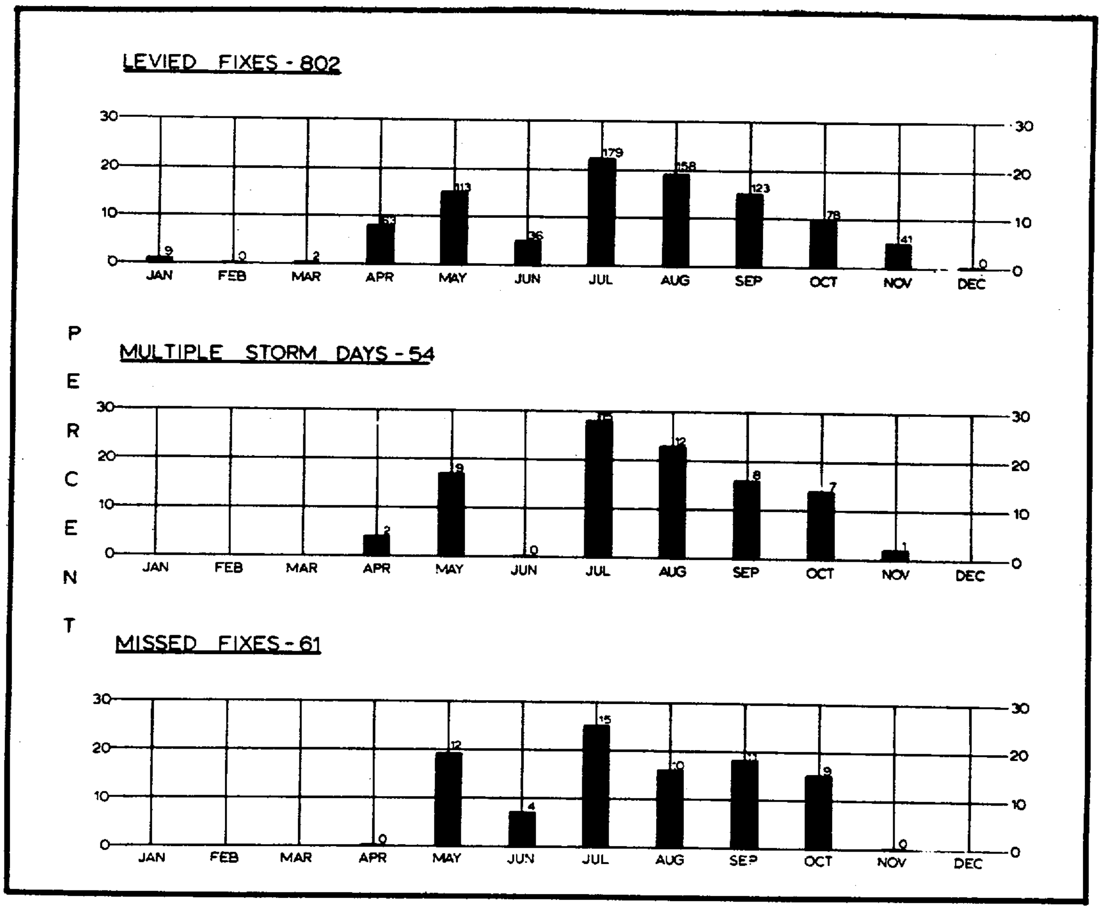

FIGURE 2-11. MISSED FIXES FOR 1971 COMPARED TO MONTHLY FIX REQUIREMENTS AND MULTIPLE-STORM DAYS.

Figure 2-11 sheds some light on why there was an increase of late and missed fixes last year. The top graph shows the monthly distribution of levied fix requirements for 1971. Two obvious peaks stand out in May and the period July through September. This past year had a total of 54 multiple-storm days and was distinguished as having the largest amount of levied fixes--almost equaling the combined total of 1969 and 1970.

The middle graph shows the monthly distribution of the multiple-storm days. It is by no coincidence that a majority of missed fixes occurred during the period of multiple storm occurrences. Fifty-four percent of all missed fixes occurred during these periods, thus illustrating the strain on assets to complete missions during periods of peak storm activity.

C. SATELLITE RECONNAISSANCE

The weather satellite has revolutionized surveillance techniques over the vast areas of the tropical oceans where tropical cyclones form. With daily coverage over these areas it is virtually impossible for a disturbance to go undetected. In most cases pre-storm disturbances are tracked for several days before the first warning is issued. Satellite pictures provide first-guess estimates for the location of disturbances which are to be investigated by aircraft reconnaissance. Infrared passes during early morning hours are especially useful for briefing purposes. After a storm attains a visible eye, the satellite picture of the storm represents a useable "fix" for locating the storm provided that the information is available to the forecaster on a real-time basis.

1. SOURCES OF DATA

During the major portion of the typhoon season, ESSA-8 was the primary and only direct readout satellite as both ITOS-1 and NOAA-1 systems were shut off due to overheating in the momentum wheel assembly of the spacecraft (Figure 2-12). ESSA-9 was reactivated and performed as the primary stored-readout spacecraft.

The ATS-1 satellite provided valuable information for storms east of 150E last season. The data from this satellite are not copied at Guam, but relay of this information by telephone has been invaluable on occasion especially when the disturbance or storm is outside Guam's area of acquisition of APT data (Figure 2-3).

SATELLITE	TYPE OF DATA	LOCAL TIME	REMARKS
ESSA 8	APT (DIRECT)	0940	PRIMARY APT SPACECRAFT JUL - DEC
ESSA 9	AVCS (STORED)	1445	PRIMARY AVCS SATELLITE JUL - DEC
ITOS-I	APT (DIRECT)	1535	REAL TIME TRANSMISSION SYSTEM
	DRSR (DIRECT)	0335	TURNED OFF 16 MARCH DUE TO TEMP
	AVCS (STORED)	1535	RISE IN SPACECRAFT MOMENTUM WHEEL
	SR (STORED)	0335	
NOAA-I	APT (DIRECT)	1520	REAL TIME TRANSMISSION SYSTEM
	DRSR (DIRECT)	0320	TURNED OFF 22 JUNE DUE TO TEMP
	AVCS (STORED)	1520	RISE IN SPACECRAFT MOMENTUM WHEEL
	SR (STORED)	0320	

APT - AUTOMATIC PICTURE TRANSMISSION
AVCS - ADVANCED VIDICON CAMERA SYSTEM
SR - SCANNING RADIOMETER
DRSR - DIRECT READOUT SCANNING RADIOMETER

FIGURE 2-12. WEATHER SATELLITES WHICH PROVIDED DATA DURING THE 1971 TYPHOON SEASON. LOCAL TIME COLUMN DENOTES AVERAGE EQUATOR CROSSING TIMES.

During the past season attempts were made to pass APT data via AUTOVON from Clark AB but due to numerous communication problems this method never proved successful. Relay of APT data from FWC Pearl Harbor is done routinely on request. Further, verbal descriptions or eye "fixes" are passed by AUTOVON or message from APT sites in WESTPAC which are outside Guam's area of acquisition in accordance with CINCPACINST 3140.1K (1971).

Problems arise when a disturbance is outside the APT acquisition area of JTWC. In these cases the forecasters at the warning center must rely on a verbal description of the area by another meteorologist at the remote site. Many disturbances are quite deceptive in their initial stages in that the clues to development or even the presence of a disturbance may be so subtle that only an experienced tropical cyclone forecaster can properly interpret the picture. Something that appears insignificant to one person may be a very important clue to the trained tropical meteorologist. For this reason it is imperative that

the warning center be supplied with real-time access to satellite data for its entire area of responsibility. This is not the case at present. Attempts to obtain the information via AUTOVON have not proven successful. Real-time coverage of the entire area will probably not be a reality until a geostationary satellite is positioned over the area.

Infrared data are particularly valuable since they allow for delineation between high and low clouds. On all satellite pictures the forecaster is looking for signs of organization in the cloud mass. The direction and magnitude of cirrus blowoff from thunderstorms are sometimes useful in determining the nature and degree of organization of upper-level outflow patterns. Evidence of low-level banding into the disturbance is also helpful in determining present and forecast intensities depending on the degree and strength of the inflow.

The Analysis Branch at the Environmental Satellite Service (NESS) reviews Advanced Vidicon Camera System (AVCS) pictures each day to locate tropical disturbances. Upon detecting a disturbance, a bulletin is issued and is relayed to JTWC which gives the position of the system and an estimate of its intensity based on a system of stages and categories of development.

Of 253 classifications made during 1971, 63% were verified as a tropical storm or typhoon, 24% were related to pre-storm development stages while 12% of the disturbances sighted failed to generate into a tropical storm. The remaining 1% were decaying or extratropical stages of tropical storms.

These bulletins are used by JTWC forecasters as late fixes if the storm is well developed or as an indication of the state of development if the disturbance is new. ESSA-9 is a stored-readout satellite not copied at Guam, thus the bulletins represent data from an independent source which can be compared to the ESSA-8 data received locally. The bulletins are especially helpful for disturbances which occur outside Guam's area of acquisition.

NESS supplied JTWC with valuable information from the ATS-1 satellite on occasion. Typhoon Mary formed north of Wake Island in an area which was beyond local APT coverage. The coordinates of the storm as given to the reconnaissance aircraft were uncertain due to an expected acceleration in forward speed. A call from NESS provided an up-to-date position of the storm based on ATS-1 data (Figure 5-23) in time to redirect the aircraft which allowed a penetration-fix of the storm. Without the call the

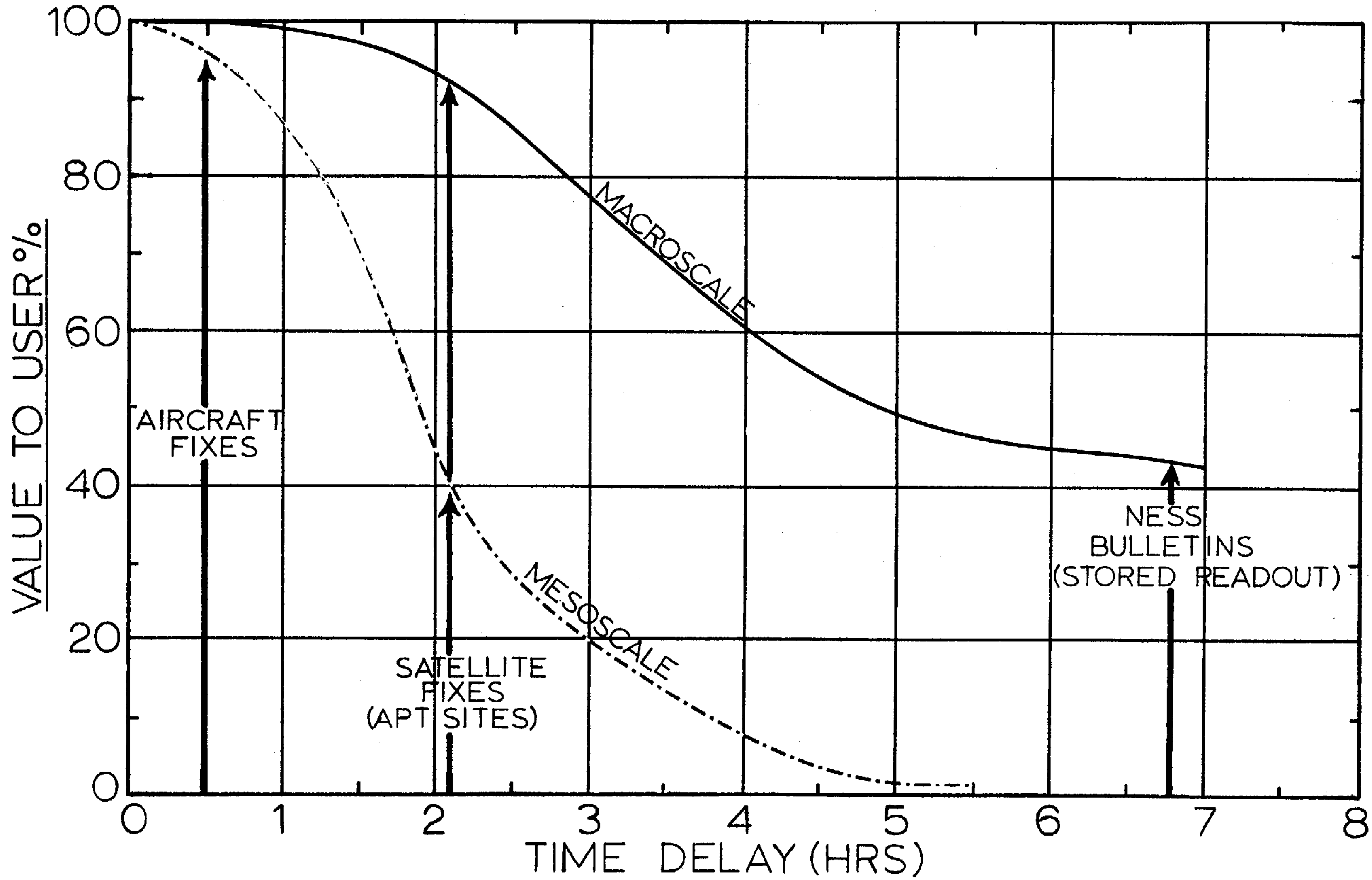

FIGURE 2-13 . VALUE OF DATA AS A FUNCTION OF TIME.

mission would have been fruitless since the estimated coordinates were in error by hundreds of miles.

Figure 5-41 is another example of the use of ATS-1 data in storm positioning. All of these data are mailed to JTWC for post-analysis purposes.

2. COMMUNICATIONS

JTWC, like all operational forecast centers, operates within a rigid time frame. In order for data to be used in a tropical cyclone warning, it must be current. Figure 2-13 illustrates the perishability of satellite data. This graph is based on a survey by the Systems Development Office of the National Weather Service and the Mitre Corporation (1969). The average time delays for aircraft fixes are indicated for reference. The curve marked macroscale refers to large scale, slowly changing information such as size and relative state of development of a storm. The mesoscale curve refers to information such as the fix position and intensity of the storm. This type of data perishes more rapidly with time as it is critical to each warning. The average time delays of just over two hours for bulletins sent from other APT sites reduces the value of the mesoscale data to below 40% of its original worth. Even larger delays, averaging nearly seven hours, are associated with bulletins from NESS.

Satellite data received live at the warning center is normally available for operational use within a half hour of the nodal crossing time. The warnings must be released to the communications center at 0530, 1130, 1730, and 2330 GMT. Taking into consideration time for receiving the satellite pass, gridding of the picture plus required interpretation, the availability of satellite information for real-time input into the warnings is restricted to satellite passes east of Guam. For disturbances west of Guam, the problem is compounded since satellite coverage is not available until 30 minutes to 2 hours after the time the warning has to be released. Of course this information can be used for verifying the accuracy of the last warning and can be the basis for an amendment in some cases. It should be pointed out here that a geostationary satellite would eliminate this problem since data would be available over the entire area every half hour.

3. POSITIONING VERIFICATION

A detailed breakdown of positioning errors* using satellite fixes is provided in Section B of Chapter 3. Table 2-6 summarizes the errors for 1971. Errors are given in nautical miles.

TABLE 2-6. POSITIONING ERRORS USING SATELLITE FIXES

STAGE	B	C	C+	X
CASES	21	31	20	97
MEAN	85	52	30	24
MEDIAN	66	34	27	23
RMS	100	71	34	29

It is obvious from the data in Table 2-6 that positioning accuracy is dependent upon the stage of development--the stronger the disturbance the more accurate the fix. The most accurate fixes are derived from storms with visible eyes. For the 58 such cases which occurred during 1971 there was a mean deviation of 22 n mi and a median error of 19 n mi. Unfortunately, an eye is visible only about 25% of the time during the lifetime of a storm (1971 statistics).

4. INTENSITY VERIFICATION

JTWC forecasters routinely derive estimates of a storm's intensity from satellite pictures by stratifying by stage (Dvorak, 1968) and further classifying the systems into categories (Hubert and Timchalk, 1969). These derived values become critical pieces of information when a reconnaissance aircraft is not in the area.

All of the NESS bulletins received during 1971 were compared to the best track maximum winds.** The results

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*Position error is defined to be the magnitude of the vector from the fix to the corresponding position in time along the JTWC best track.

**Best track winds are determined after a careful post-analysis and are probably within ± 10% of the actual maximum wind.

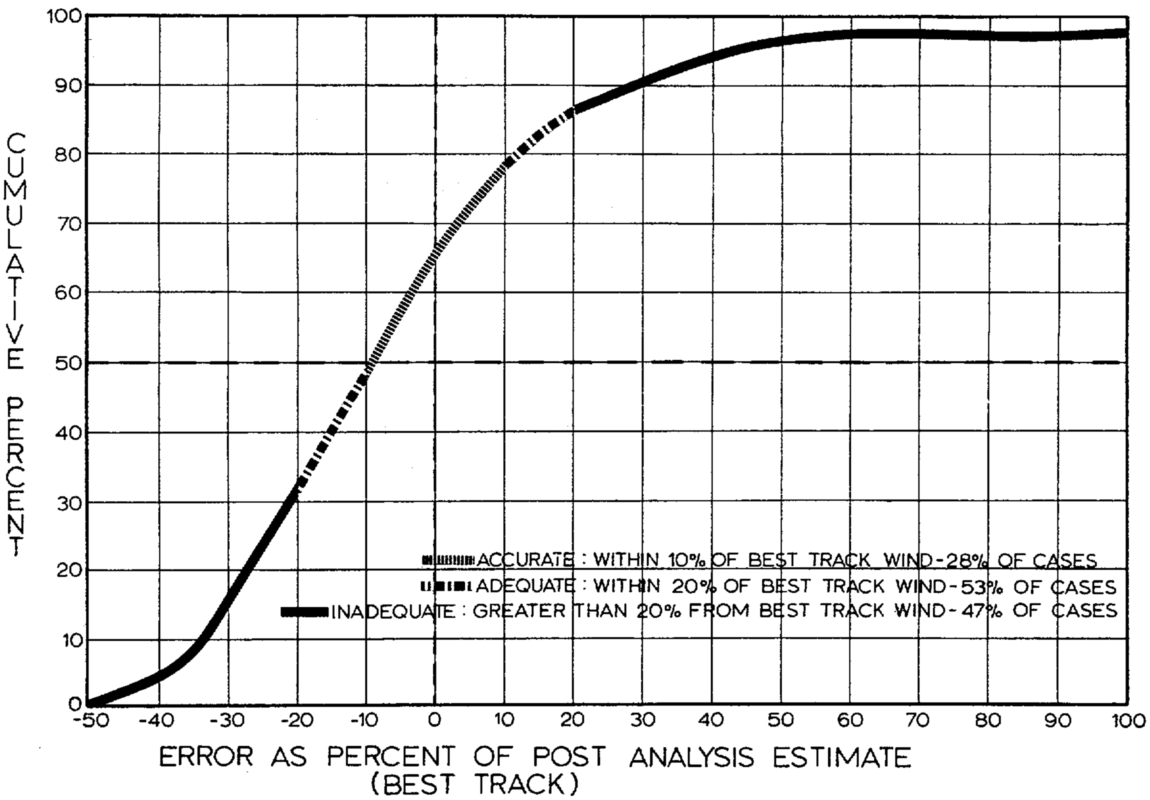

FIGURE 2-14. VERIFICATION OF SATELLITE WIND ESTIMATES. PERCENT ERROR IS COMPUTED BASED ON BEST TRACK POST-ANALYSIS. THE GREATER AREA UNDER THE CURVE TO THE LEFT OF ZERO THAN ABOVE THE CURVE TO THE RIGHT OF ZERO INDICATES THAT THE SATELLITE ON THE AVERAGE TENDS TO UNDERESTIMATE THE ACTUAL WIND SPEED.

are shown in Figure 2-14. Derived winds within 10% of the best track wind are considered accurate and any wind within 20% is considered adequate for input into the warning. Only 53% of last year's satellite-derived winds were considered adequate. The remaining 47% were not acceptable estimates.

A technique aimed at improving the present intensity classification system is now in the experimental stage. Developed by a member of the Analysis Branch at NESS, the system is based on seven classes of development. This new technique appears to overcome some of the deficiencies of the system, however, any conclusion at this point would be premature. Hopefully, by the end of the 1972 typhoon season, a complete evaluation of the system will be available.

It should be pointed out that <u>any</u> classification scheme has exceptions. These anomalies can become nightmares to the tropical cyclone forecaster if satellite data are all that is available. As a case in point, Figure 2-15 is an ESSA-9 view of typhoon Rose on the 16th of August, within hours of striking Hong Kong. Since the storm was past the restricted no-fly line, an aircraft penetration was impossible. The NESS classification system determined the

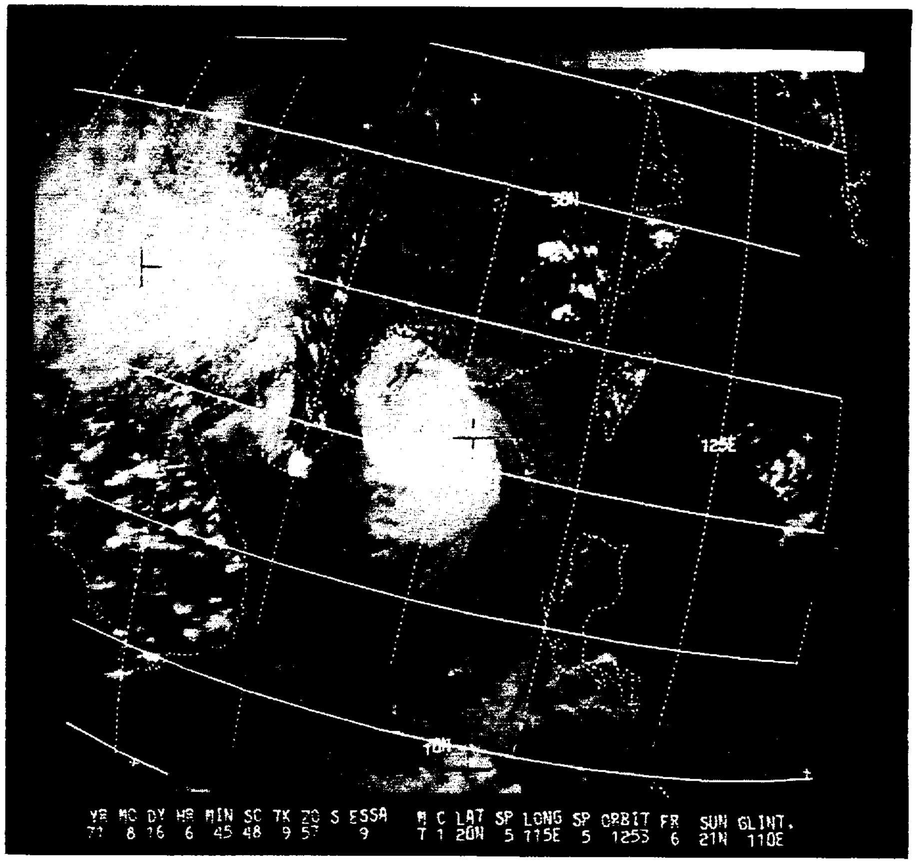

FIGURE 2-15 TYPHOON ROSE MOVING ON A NORTHERLY COURSE TOWARD HONG KONG 16 AUGUST 1971.

intensity of Rose to be 75 to 80 kt. Post analysis of Rose using ship data close to the eye and one ship which passed through the eye* indicated maximum sustained winds of 115-120 kt--a 50% error in the satellite estimate. This is all the difference between a moderate blow and a disaster.

D. LAND RADAR RECONNAISSANCE

Over 600 storm fixes from land radar sites were received during 1971. This reconnaissance tool provided hourly fixes to the JTWC when a storm was within the envelopes of radar coverage indicated in Figure 2-3. In one instance (typhoon Irma as she approached Okinawa) three-hourly fixes levied by an operational commander were canceled by the warning center when the storm entered the area of land radar coverage thus saving one complete aircraft reconnaissance mission for that particular day. This is an excellent example of the symbiotic relationship which is desired among the available reconnaissance tools.

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*None of these data were available at the time of the forecast.

1. SOURCES OF DATA

Radar reports are received from over 50 different sites in the western Pacific and Southeast Asia. Past annual reports list these stations by name and give characteristics of the radars (FWC/JTWC, 1970). The most timely and reliable data are received from the excellent network which exists in Japan and the Ryukyu Islands and is administered by the Japanese Meteorological Agency. Figure 2-16 is an example of the radar presentation of typhoon Billie as seen by the radar located at Naze, Anami-o-shima Island in the Ryukyu chain.

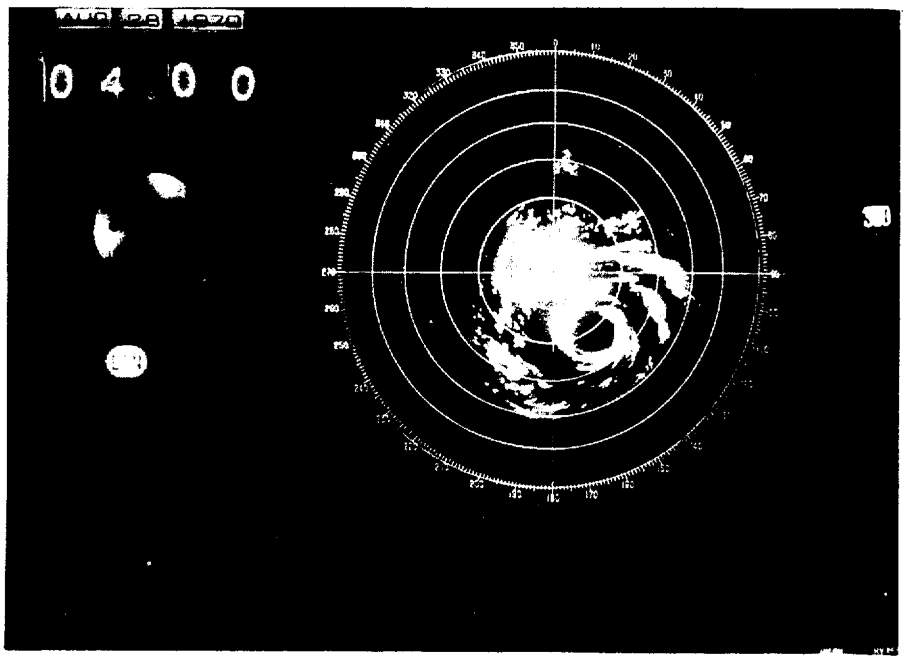

FIGURE 2-16 THE EYE OF TYPHOON BILLIE ON 27 AUGUST 1970, 1900 GMT AS VIEWED BY THE NAZE RADAR (10.4) ON AMAMI-O-SHIMA ISLAND RANGE MARKS ARE AT 100 KM INTERVALS (PHOTOGRAPH COURTESY OF JAPAN METEOROLOGICAL AGENCY.)

Many reports are telephoned to JTWC by other weather agencies throughout the area. The personnel at OL B, 1WWg, Taipei AS provide excellent relay service via AUTOVON when a storm is nearby. Similar service is provided for storms approaching the coast of Vietnam by the personnel of the SEA Weather Central in Tan Son Nhut. The Naval Weather Service Environmental Detachment (NWSED) at Cubi Point, Republic of the Philippines acts as coordinator for

relay of all radar fixes received from Philippine radars including ADCC sites. The forecasters at Kwajalein have also provided valuable information on many occasions.

The 10-cm radar located at the Royal Observatory in Hong Kong is critical for warning residents of the colony since the no-fly line prevents aircraft from entering the coastal waters. The last aircraft fix on typhoon Rose was made when the storm was still over 120 n mi from the coast. The sharp turn toward the north was not indicated by fixes up until this time. Only after the Royal Observatory began tracking the storm was it clear that Rose was making a hard turn toward Hong Kong.

2. UTILIZATION OF DATA

Radar fixes are normally received at one-hour intervals. In many cases fixes from more than one site are available, especially in the vicinity of Japan. Normally an estimate of the accuracy such as good, fair, or poor is given. These provide guidelines in assigning weights to fixes when more than one is available. If the accuracy of the fixes are the same then normally the station nearest the storm is given more weight.

Because of the short-term oscillations of speed and direction of movement about the mean patch of the storm, speed and direction determinations on a fix-to-fix basis are notoriously unreliable. Instead, the movements from the positions 6 and 12 hours ago to the latest radar fix are used as measurements of current speeds.

Another problem sometimes arises when a storm is on the outer limits of a radar's range. In these cases the radar can observe only the highest clouds near the wall cloud, and a complete presentation of the eye is not always possible.

3. POSITIONING VERIFICATION

Based on 1971 data for typhoons only (412 cases), land radar is able to fix a storm with a mean error of 12 n mi, a median error of 10 n mi, and rms equal to 14 n mi. These values are only slightly greater than those associated with aircraft fixes. Unfortunately, the critically needed measurements of intensity can only be obtained by aircraft penetration. For a more complete error analysis of land radar fixes refer to Chapter 3.

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CHAPTER 3

TECHNICAL NOTES

A. A STUDY ON THE VALUE OF THREE-HOURLY FIXES

1. INTRODUCTION

At the 1971 PACOM Tropical Cyclone Conference a proposal to increase fix frequency from four per day to eight per day under certain circumstances was recommended for CINCPAC approval. This increased frequency was to apply when a typhoon threatened a major DOD installation in WESTPAC. CINCPAC approved this recommendation during April 1971.

The underlying reason for this change was a response to operational commanders' expressed desires, more to monitor track and intensity rather than improve forecasts. A study by Hope (1971) suggests that more frequent fixes reduces initial position error. Since short range forecasting (12 to 24 hours) is almost entirely extrapolation, one should expect to see a corresponding reduction in 12- to 24-hour forecast errors. Hope's work applied to Atlantic hurricanes, and differences in operational procedures suggest that his results might not apply to Pacific typhoons.

The hurricane initial position is based on a fix made two hours after warning time; in other words, the initial position is an interpolation between known points. The JTWC initial position is based on a fix made two hours before warning time, thus the initial position is an extrapolation. Increased sampling necessarily improves interpolation but not extrapolation. Extrapolation suffers when the sampling interval becomes so small that inaccuracies in measurements are of the same order of magnitude as likely changes in the measured parameter between samples. For example, if fix accuracy is about 12 miles and the indicated typhoon movement 12 kt, the actual speed between fixes at three-hourly intervals could be 4-20 kt and 8-16 kt at six-hourly intervals. Thus from a position uncertainty of 12 miles, a three-hourly movement extrapolated forward for two hours will add 16 miles where a six-hourly movement extrapolated would add 8 miles to this uncertainty. In interpolation the maximum uncertainty is limited by the average of the errors in the fixes on either side of the interpolated position.

At JTWC 12-hour movements are extrapolated when available, but when a key DOD installation is being threatened, it is difficult to totally ignore a shorter term movement if such indicates an increased threat.

The unusually heavy demand on reconnaissance during 1971 coupled with asset reduction forced abandonment of three-hourly fixes after October 1971, but a measure of the success of the program is desirable for future consideration.

2. A MEASURE OF IMPROVEMENT

By comparing forecasts based on three-hourly fixes to those made on six-hourly fixes, we should be able to measure the forecast improvement due solely to the increased fix frequency. In so doing, it becomes apparent that if an improvement is noted, that subsequent forecasts would be positively effected for a short while after cessation of three-hourly fixes; therefore, no forecasts made after cessation of three-hourly fixes were considered. Another possible red herring is that the three-hourly fixes are invariably made close to land. This implies a superior data area but is also an area where terrain influences are at work to degrade forecasts. To evaluate the effect of three-hourly fixes, it is first necessary to ascertain the effect on forecasts of typhoons approaching within 300 miles of key DOD installations without three-hourly fixes. This was done by using a control group of forecasts from 1968, 1969 and 1970. These forecasts were divided into sub-groups of those within 300 miles of key DOD installations and those not within the 300-mile circles. In the control group also, no forecasts were used after leaving a 300-mile circle. Table 3-1 shows the sample sizes in the groups tested.

TABLE 3-1. CONTROL GROUP SAMPLE POPULATION

	WITHIN 300 MILES OF KEY DOD INST.	OUTSIDE 300-MILE CIRCLE	TOTAL
Control Group 1968, -69, -70	224	382	606
Test Group 1971	126*	186	312
TOTAL	350	568	918

*These forecasts were based on fixes at three-hourly intervals.

3. RESULTS

In all three control years the forecasts made near land were significantly superior to those made over open ocean. Table 3-2 compares the average 24-hour forecast errors for the years within the control group.

TABLE 3-2. CONTROL GROUP
AVERAGE 24-HOUR FORECAST ERRORS

	1968	1969	1970	ALL
Within 300 Miles of Key DOD Inst.	91.5	93.4	84.6	89.1
Outside 300-Mile Circle	99.7	101.9	99.5	100.1
All	97.1	98.9	92.7	96.0

From these results one must conclude that, exclusive of other influences, forecasts are superior within the better data region near land.

Table 3-3 compares the average 24-hour forecasts errors from 1971 when three-hourly fixes were required to the control group.

TABLE 3-3. AVERAGE 1971 24-HOUR FORECAST ERROR
COMPARED WITH CONTROL GROUP

	1971	CONTROL GROUP	ALL
Within 300 Miles of Key DOD Inst.	93.9	89.1	90.8
Outside 300-Mile Circle	87.4	100.1	95.9
All	89.7	96.0	93.9

This comparison reveals two striking contrasts. First, 1971 was the best of the four years for forecasts made over open water and secondly 1971 was the worst of the four years for forecasts made within the 300-mile circles.

There are variations from year-to-year that are not explained here, but the conclusion is inescapable that three-hourly fixes not only did not enhance forecasting capability but, in fact, had a detrimental effect.

4. THE PARADOX

The general superiority of forecasts near land to those over open water was not unexpected. The reversal of this superiority solely attributed to more frequent fixes is counter to the meteorologists' long standing tenet that more data leads to better forecasts. This phenomena might be called the meteorologists' paradox "more data--worse forecasts".

Some rationale for this paradox is in order. The following effects are considered contributory:

a. The addition of three-hourly fixes increased the reconnaissance burden by 30% during the time period when a storm was threatening a key DOD installation. The increased burden was accompanied by a proportional increase in the missed-fix frequency--thus more six-hourly fixes were missed resulting in a disruption of the 6- to 12-hour running continuity of movement and forcing increased reliance on shorter term continuity.

b. When a key installation is being threatened, forecasters are tempted to hedge toward short-term trends when these suggest an increased threat. The "course of least regret" (Simpson, 1971) is considered.

c. Short-term trends were being evaluated near land where terrain influences cause erratic motion, thus making the indicated fix-fix movement even less reliable than over open water.

5. CONCLUSIONS

The requirement for three-hourly fixes has been changed to a request basis by operational commanders and then only if resources permit. This would tend to reduce the cases where a three-hourly fix causes the loss of a six-hourly fix.

The objective of the three-hourly fix program was not to improve 24-hour forecasts. This was an expected spin-off which obviously was not realized. The primary purpose of this program was monitoring for early indications of changes in track or intensity. The extent to which this purpose was served was not evaluated directly, but the results of this study tend to indicate that such early indications, at least with regard to track, are likely to be misleading.

B. COMPARISON OF EXPECTED ERRORS FROM VARIOUS RECONNAISSANCE PLATFORMS

1. INTRODUCTION

The tropical cyclone forecaster is constantly confronted with the task of evaluating eye "fixes" from several different reconnaissance platforms. He must determine how much weight to give each fix in determining the best possible estimate of the storm's true position. Unfortunately, this process of determining weighting factors has been rather subjective until recent years. Simpson (1971) has attempted to make this decision process objective by constructing decision ladders to aid the forecaster. Such techniques are needed to introduce consistency into the determination process and to guide the forecaster's reasoning so as to guarantee the selection of the best possible position.

The purpose of this technical note is to report on a preliminary investigation of expected errors associated with various reconnaissance platforms. These errors are computed using the post-analysis "best track" (BT) constructed by the Joint Typhoon Warning Center (JTWC). The probability that an error of a given magnitude will occur can then be empirically derived by grouping the errors into cumulative frequency distributions. The comparison of "probable" errors at any given level of confidence can then be made to determine weights to be used in the decision process.

It should be noted that this is only a preliminary investigation utilizing data from the 1971 typhoon season. A more complete investigation using data from several years is desirable.

2. THE BEST TRACK AS A STANDARD

The JTWC BT is used to compute an "error" for each fix. Since all of the results of this study hinge upon deviations from the post-analysis position, the validity of using the BT as a standard should be addressed before going further.

The BT is constructed several weeks (often months) after a storm occurs. This time lag insures that all available data arrive at the warning center for input into the post-analysis.

The BT is a smooth curve passing as nearly as possible through all fixes and amplifying data. It represents the best guess as to the path of the surface wind center and consists of points defined to the nearest 10th of a degree at six-hourly intervals during the life of a storm. The track is smoothed in speed, direction and maximum wind intensity. All types of fixes are considered; their weaknesses and strong points insofar as known are evaluated to determine proper weights for each fix. Synoptic data is used as a gross error check on fix positions. A storm track with a history of oscillation is allowed to retain that oscillation, where a single point removed from an otherwise smooth track may be partly discounted. Wind estimates are considered to be within 10% of the actual wind.

In summary, the BT is the best possible estimate of the actual track of the storm. A certain degree of subjectivity is always present, but in most cases simultaneous information from more than one source results in realistic "bounds" on the possible tracks that could be drawn. Since fixes are normally at six-hour intervals, any real oscillation with a period less than six hours will go undetected. If this oscillation is of the order of 3-5 n mi about the mean track then the fixes will be scattered randomly on either side of this actual track. Thus one should keep in mind that the errors referred to in the following paragraphs may actually be a few miles less. This does not, however, invalidate comparison of relative errors.

3. TABULATION OF DATA

A computer program was written to process all fixes received during the 1971 typhoon season. Fixes were segregated into three major categories--aircraft, land radar, and satellite.* The error, or deviation from a time interpolated point on the BT was then computed for each fix and all errors for each category were grouped into cumulative frequency distributions.

Figure 3-1 shows cumulative frequency distributions for aircraft fixes made by penetration of the eye and satellite fixes for all tropical cyclones during the year regardless of intensity. It is very evident that aircraft fixes (8 n mi median) are much more accurate than satellite fixes (25 n mi median). At the 70% level the ratio is

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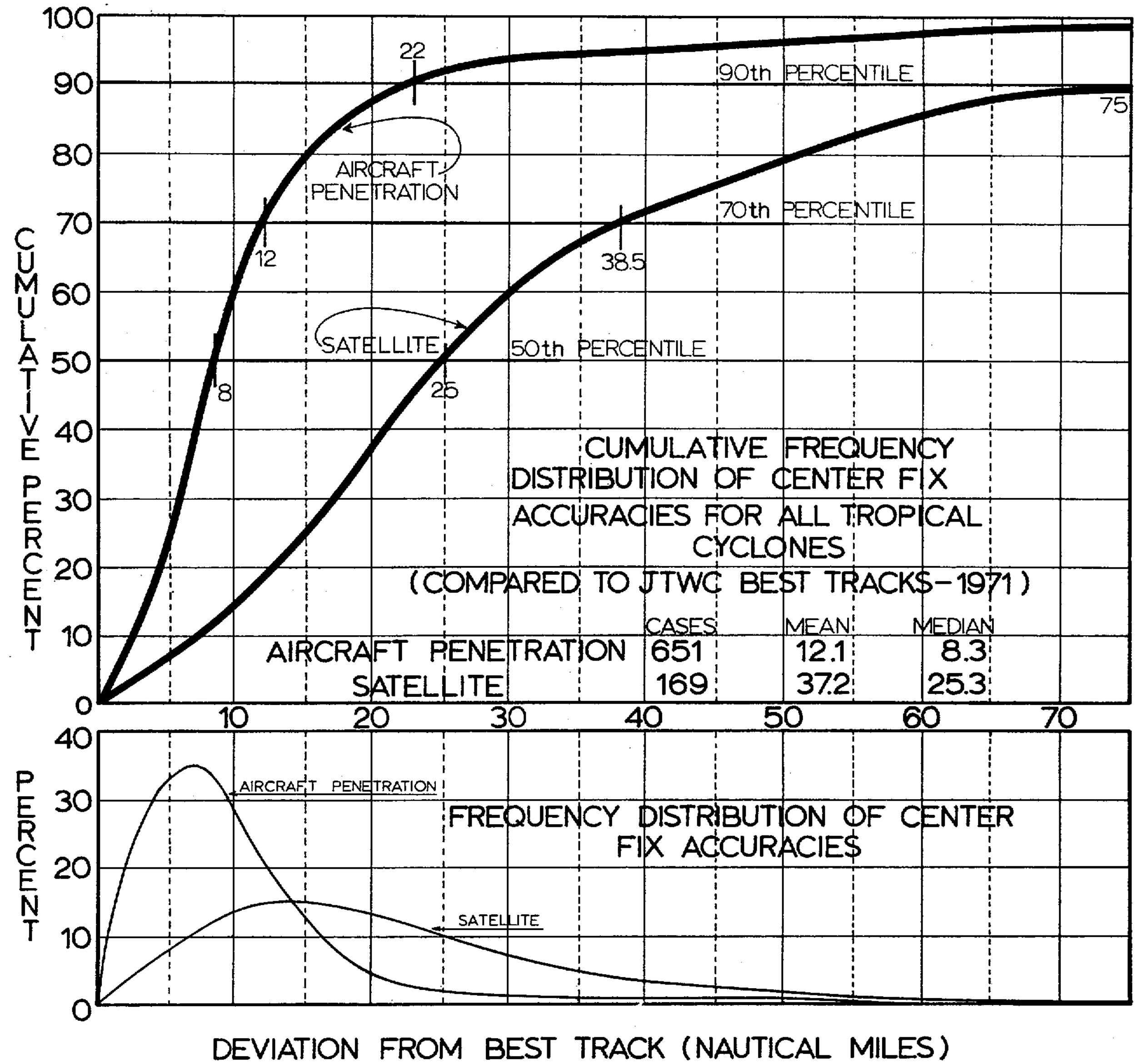
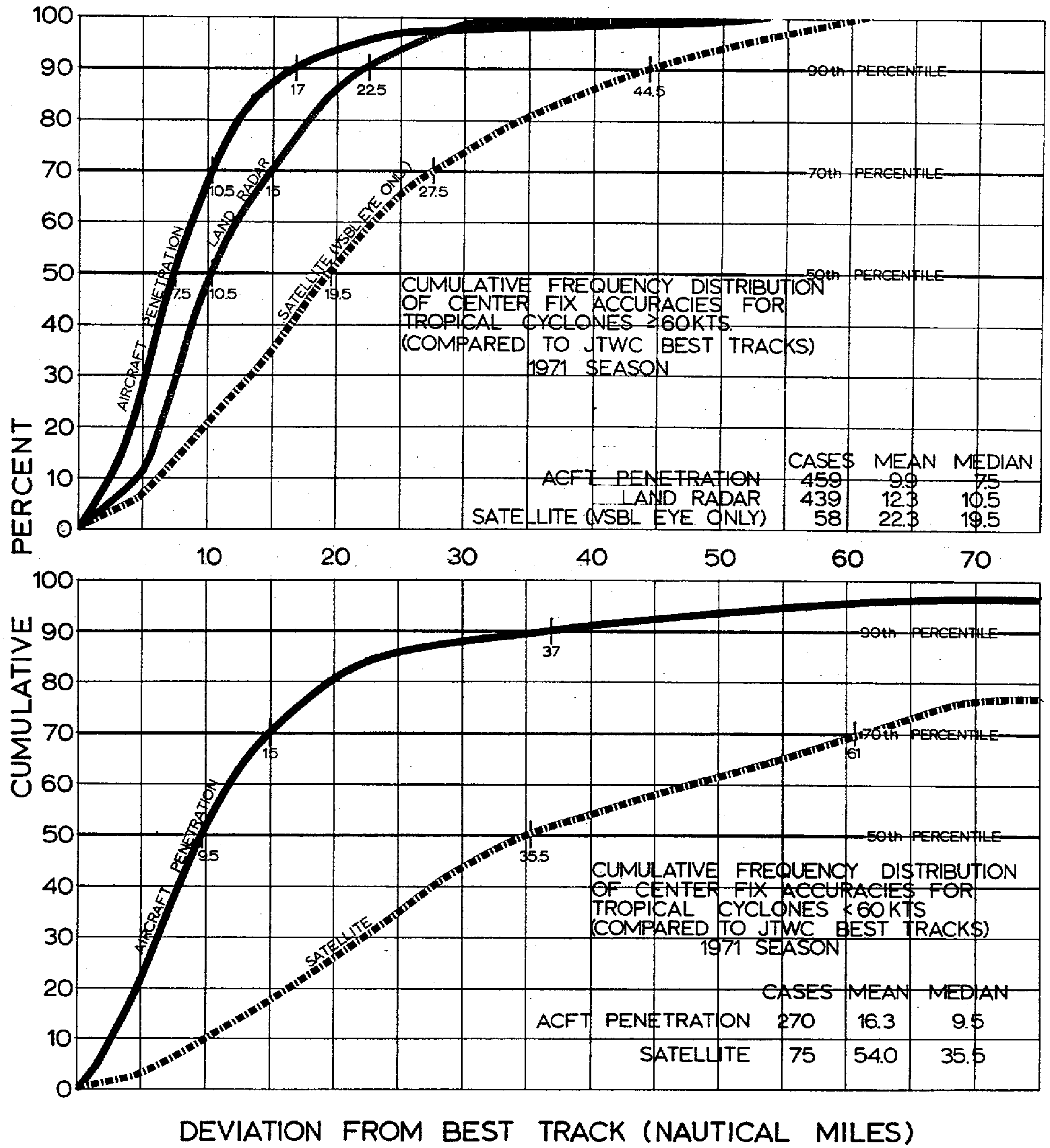
*All satellite data was received from the National Environmental Satellite Service.



CUMULATIVE PERCENT
90th PERCENTILE
70th PERCENTILE
50th PERCENTILE
AIRCRAFT PENETRATION
SATELLITE
22
12
8
38.5
25
75
CUMULATIVE FREQUENCY DISTRIBUTION OF CENTER FIX ACCURACIES FOR ALL TROPICAL CYCLONES
(COMPARED TO JTWC BEST TRACKS-1971)
CASES MEAN MEDIAN
AIRCRAFT PENETRATION 651 12.1 8.3
SATELLITE 169 37.2 25.3
PERCENT
FREQUENCY DISTRIBUTION OF CENTER FIX ACCURACIES
AIRCRAFT PENETRATION
SATELLITE
DEVIATION FROM BEST TRACK (NAUTICAL MILES)



CUMULATIVE FREQUENCY DISTRIBUTION OF CENTER FIX ACCURACIES FOR TROPICAL CYCLONES ≥60KTS. (COMPARED TO JTWC BEST TRACKS) 1971 SEASON
CASES MEAN MEDIAN
ACFT PENETRATION 459 9.9 7.5
LAND RADAR 439 12.3 10.5
SATELLITE (VSBL EYE ONLY) 58 22.3 19.5
AIRCRAFT PENETRATION
LAND RADAR
SATELLITE (VSBL EYE ONLY)
90th PERCENTILE
70th PERCENTILE
50th PERCENTILE
17
22.5
44.5
10.5
15
27.5
7.5
10.5
19.5
CUMULATIVE FREQUENCY DISTRIBUTION OF CENTER FIX ACCURACIES FOR TROPICAL CYCLONES <60 KTS (COMPARED TO JTWC BEST TRACKS) 1971 SEASON
CASES MEAN MEDIAN
ACFT PENETRATION 270 16.3 9.5
SATELLITE 75 54.0 35.5
AIRCRAFT PENETRATION
SATELLITE
37
15
9.5
35.5
61
CUMULATIVE PERCENT
DEVIATION FROM BEST TRACK (NAUTICAL MILES)

still about 3:1 with errors of 12.0 and 38.5 n mi for aircraft and satellite respectively.

More insight into the relative accuracies of the reconnaissance platforms can be obtained by segregating the tropical cyclones into two groups--one greater than or equal to 60 kt and the other less than 60 kt. Figure 3-2 shows cumulative frequency distributions for these categories. The lower graph illustrates the most difficult conditions for all reconnaissance platforms. It includes storms which range from weak tropical depressions to strong tropical storms. Aircraft fixes are still below 10 n mi for this category, but satellite fixes, suffering in most cases from the lack of a well-defined eye or center of circulation, have a median error of over 35 n mi and an expected error of over 60 n mi at the 70% level. The upper curve shows expected errors for tropical cyclones 60 kt or greater. The satellite data used in this graph were restricted only to those storms exhibiting visible eyes. This was done purposely so as to use satellite data which was derived under optimum conditions. Again, aircraft penetration is the most accurate method (7.5 n mi median), but land radar is close with a median error of 10.5 n mi. Satellite fixes have a respectable median error of 19.5 n mi. Unfortunately, visible eyes were present in only 25% of the cases during 1971.

4. CONCLUSION

The expected errors derived from the 1971 data are good first-guess estimates which can be applied operationally by the tropical cyclone forecaster. By evaluating expected errors at some arbitrary observed probability level, say 70%, the forecaster can construct circles of probability about each fix to determine the best possible position of the storm. Thus the expected errors can be considered to be inverse weighting factors for each type of fix.

C. RATE OF INTENSIFICATION STATISTICS FOR 1971 TROPICAL CYCLONES

The statistics contained in Table 3-4 are based on development rates determined from individual averages for 37 tropical cyclones during 1971. Studies of the rate of intensification of tropical cyclones have been carried out in the past, e.g. Auchterlonie (1970), Brand (to be published), but none have documented the time sequence of events from the initial birth of the tropical disturbance. The information provided in this table, though based on a relatively small sample illustrates quite well the shorter time periods required for development during the latter months of the year.

TABLE 3-4. RATE OF INTENSIFICATION STATISTICS FOR 1971 TROPICAL CYCLONES

TIME PERIODS	JAN FEB MAR	APR MAY JUN	JUL AUG SEP	OCT NOV DEC	ANNUAL AVERAGE
INITIAL DETECTION* TO TROPICAL DEPRESSION	5.2 days	4.0 days	2.6 days	2.0 days	3.0 days
INITIAL DETECTION* TO TROPICAL STORM	6.5 days	6.0 days	3.8 days	3.5 days	4.3 days
INITIAL DETECTION* TO TYPHOON	---	8.6 days	5.3 days	4.8 days	6.0 days
TROPICAL DEPRESSION TO TYPHOON	---	4.6 days	2.7 days	2.8 days	3.0 days
TROPICAL STORM TO TYPHOON	---	2.6 days	1.5 days	1.3 days	1.7 days

*Initial detection of the tropical disturbance.

D. JTWC WARNING TIMES

JTWC issues typhoon warnings at fixed times six hours apart (four per day) because this schedule matches the meaningful time variation in tropical cyclone parameters, provides for optimum utilization of forecast resources, and best satisfies the requirements of the JTWC customer.

First of all, climatology shows that the real variations in the pressure, temperature, and wind fields associated with a tropical cyclone occur predominantly on the order of hours. Likewise, the position and velocity of a storm changes on this same time scale. To put meaningful information into a typhoon warning, it is imperative that the storm measurement/warning frequency match the frequency of real variation in these key storm parameters. If the time between measurements/warnings were on the order of tens of hours (twice a day, daily, etc.), significant changes would occur between the measurements/warnings. On the other hand, if this time period were on the order of tenths of hours (minutes), various types of noise would obscure the real variation in the storm parameters. Thus, the nature of the phenomenon itself dictates that the time between warnings be on the order of hours.

Secondly, and perhaps more importantly, JTWC warning times are constrained by the scheduled availability of data, manpower, and time resources. The 6/12-hour frequency of meteorological observations established by international agreement determines the receipt frequency of data fields and numerical progs used in JTWC subjective and objective techniques. Warnings issued more frequently than every six hours would contain no new information, while warnings issued less frequently than every 6/12 hours would neglect new information.

In like manner, efficient utilization of reconnaissance aircraft requires specific limits on the time between warnings. If the warning times, and therefore the fix times, are scheduled approximately six hours apart; one aircraft (WC-130) can normally handle two fixes in one mission, and two aircraft can handle the four daily fixes on any one storm. On the other hand, a period longer than six hours, such as eight hours, would normally require one mission per fix thereby yielding a smaller number of fixes for a greater expenditure of aircraft resources.

Additionally, the 12-hour watch routine at JTWC is built around the two fixed warning times falling within that watch. Each task is sequenced in a coordinated step-wise

fashion toward the construction of a sound warning. This routine has been standardized from one watch to the next and also facilitates the training of new personnel. Variation of the task schedule from one watch to the next would confuse and complicate the warning process resulting in the loss of valuable time.

Finally, and perhaps most important, JTWC warning times must satisfy the requirements of the customer. JTWC customers want warnings as often as new data is available, thereby necessitating warnings at least every six hours. In addition, the customer's mission planning and decision-making processes are designed to incorporate JTWC warning information at specific times each day. Field commanders would not readily change their briefing times each day to fit the JTWC warning times. This requires the warning interval to be a number of hours that will evenly divide into 24.

The above constraints taken together require four warnings per day at fixed times six hours apart. The only latitude remaining is the choice of the specific warning hours within the day. Based on operational experience JTWC has found 0000Z, 0600Z, 1200Z, and 1800Z to be optimum.

E. A STATISTICAL STUDY OF RAPID DEEPENING IN TYPHOONS

1. INTRODUCTION

The occurrence of rapid deepening is a subject of concern to the typhoon forecaster as this process is often "explosive" in nature, taking place in a time frame of a day or less. Little skill has been exhibited in foreseeing these events which may have potentially disastrous consequences to forces afloat or ashore due to the short reaction time to afford protective measures.

Other than Ito (1961) and Jordan (1961), little documentation on rapid intensification of typhoons has appeared in literature. This note is a brief statistical review utilizing a larger data base which has accumulated since the appearance of the aforementioned studies.

2. PROCEDURE

The data used were aircraft reconnaissance reports contained in past copies of the Annual Typhoon Report prepared by Fleet Weather Central/Joint Typhoon Warning Center, Guam. Rapid intensification was measured by means of the central pressure of the typhoon. This parameter is considered a more reliable and conservative measure of intensity than the maximum winds and is not as likely to be biased by sampling procedures (Colon, 1963 and FWC/JTWC, 1970).

In order to obtain a meaningful sample, several restrictive criteria were introduced. Since the majority of typhoon penetrations were at the 700-mb level, a regression equation developed by Jordan (1957) employing the minimum 700-mb height was used to screen for errors in central pressures obtained by dropsonde. Since geopotential heights at the 700-mb level generally were not available in Annual Typhoon Report's prior to 1956, the sample was limited to the 16-year period from 1956 to 1971.

The 24-hour interval was chosen for study since reconnaissance observations were usually available at least once a day, and this interval represents the time period during which major last-minute precautions such as aircraft evacuation, ship sortie, and evasion can still be taken. As intervals between aircraft fixes were often irregular, a limit of ±3 hours was placed on the end points of the 24-hour period to insure that the rates of deepening would be representative. All data were normalized to a 24-hour interval. The above restrictions eliminated 57 of the

312 typhoons occurring in the 16-year period. The remaining 255* typhoons are considered to constitute a reasonable sample upon which to build a reliable climatology.

A frequency distribution of the useable data as to maximum 24-hour deepening is shown in Figure 3-3. The highest frequency appears in the 10 to 30 mb/24-hour interval centered on a median of 23 mb/24 hour. In this note, intensification of ⩾30 mb in 24 hours (1.25 mb/hour) will be considered as the criteria for rapid deepening.

Of the 255 typhoons in the sample, 37% or 95 storms had at least one case of 24-hour deepening ⩾30 mb during their histories (Table 3-5). For purposes of perspective, during the same period 1956-1971, only 9 of 87 (or 10%) of Atlantic hurricanes exhibited a similar 30 mb/24-hour deepening.**

3. THE DEEPENING PERIOD

Frequencies of central pressures of typhoons when rapid deepening began are displayed in Figure 3-4. These data indicate the majority of the deepening (81%) commenced in the interval 960 to 989 mb with a peak of 35% occurring for the 970 and 979 mb category. Using the equation derived by Takahashi (1939), in which a mean pressure of 975 mb for the interval equates to 80 kt, this would seem to indicate a certain stage of development must be reached prior to the start of rapid deepening.

A comparison was made between the time of the commencement of rapid deepening relative to the time typhoon force was first attained. Figure 3-5 shows the frequency of the onset of rapid deepening in terms of time before, or after, typhoon force (64 kt) was attained. To minimize the effect of time-interval variations, relative times were rounded to the nearest even 12 hours. Figure 3-6 shows that in 75% of the cases under consideration rapid deepening occurred within 36 hours after typhoon generation. It is also evident that 91% of the cases begin at or after typhoon strength is achieved.

The data presented in Figures 3-4 and 3-5 support a hypothesis that a certain organization to the tropical

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*Includes Kit, Jan 1972.

**Source - Annual hurricane summaries appearing in Monthly Weather Review.

cyclone must be achieved before rapid deepening can occur. Jordan and Frank (1961) and Dunn and Miller (1960) have noted that the formation of an eye closely corresponds with the development of hurricane-force winds. The presence of an eye wall probably is the prerequisite before the central pressure will show a rapid rate of reduction.

On the other end of the time frame for deepening, a two-day limit appears to exist if rapid intensification is to occur, since 84% of the sample under consideration began maximum deepening prior to 60 hours after the onset of typhoon force winds. A few obvious reasons, such as short-lived typhoons that strike land or those that have recurved, probably account for much of this. However, many typhoons fall into neither group. For these cases there are apparently some mechanisms for rapid deepening available soon after the attainment of typhoon force which is unlikely to be available later.

4. EXTREMES

A distribution of the frequencies of the ≥30 mb/24-hour cases by 10-mb intervals appears in Figure 3-6. Extremes of ≥60 mb/24 hour (2.5 mb/hour), or twice the rapid deepening rate under consideration, were in evidence in 19 (or 20%) of the 95 rapid-deepening cases during the 16-year period. Two of the most extreme intensification rates occurred in typhoons Ida (1958 which culminated in an 86-mb drop in a 22 1/2-hour period (3.8 mb/hour) and Irma (1971) in which a 97-mb drop in 24 1/2 hours (4 mb/hour) was recorded.

Reconnaissance data were frequent enough to determine a maximum 12-hour rate for 75 of the 95 cases of rapid deepening while a maximum 6-hour rate could be found for 65 cases (Table 3-6). Thirty-seven typhoons displayed an intensification rate of ≥30 mb in 12 hours (2.5 mb/hour) while four achieved ≥30 mb in 6 hours (5 mb/hour). These cases fall in a category of their own and must be regarded as extreme examples of "explosive" deepening.

5. SEASONAL DISTRIBUTION

The yearly occurrence of ≥30 mb deepening per 24 hours gives a rather uneven distribution ranging from ten in 1968 to one in 1960 during the period of the sample (Table 3-5). However, with 18% of the total typhoons during that interval not useable due to the restrictions of the study, this must be considered only a partial picture.

The total monthly frequency shown in Table 3-7 displays a distribution with greatest occurrences from July to November (75%). Two peaks show in the data; the major one is in September which coincides with the month of greatest super typhoon activity (FWC/JTWC, 1970). The secondary peak takes place in November; however, this month exhibits a higher probability of typhoons undergoing rapid deepening than in September. Comparing the data sample to the total number of typhoons occurring during the period 1956-1971 by month--September with 65 typhoons gave a ratio of 41%, while the 29 typhoons for November resulted in a ratio of 52%.

6. GEOGRAPHICAL DISTRIBUTION

The distribution of segments of the 95 typhoons where deepening ≥30 mb/24 hour took place is displayed in Figure 3-7. Ninety-three percent of the tracks were on a heading between 350°-250° which would serve to emphasize that maximum deepening occurs before recurvature. This supports Riehl's (1971) findings which indicated that maximum intensity is reached prior to recurvature.

The majority of the track segments are concentrated in the latitude belt between 10N and 20N and longitudes of 125E and 155E. Solid lines are for typhoons occurring between July and November and represent the main season while the dashed lines are typhoons which occurred between December and June. The lone occurrence documented in the South China Sea was Harriet (1971) while the track with the highest latitude was described by Trix (1971).

The points of initial rapid deepening are displayed in Figure 3-8. The latitude and longitude of these points were averaged for each five-degree Marsden square to represent the centroid of the points contained in the square. The areas of maximum frequency are concentrated in the west central Philippine Sea and just east of the Marianas island chain. This resembles the double maximum distribution shown to occur in the first points of super typhoon intensity (FWC/JTWC, 1970 and Fung, 1970) for minimum pressure in typhoons. However, the rapid deepening maximum is displaced 5 degrees to the east of the first study mentioned--a logical location upstream for westward moving typhoons. The display does not show any significant minimum between the two maximum centers as charted in the 1970 Annual Typhoon Report.

7. SUMMARY

Data for the years 1956 through 1971 indicate occurrence of 95 cases of rapid deepening to the extent of ⩾30 mb in a 24-hour interval. Extremes of over twice this rate of deepening were noted as instances of ⩾30 mb in 12 hours were not uncommon (15% of useable sample). The maximum frequency (75%) was found to begin in the period from the point where initial typhoon force was achieved to 36 hours afterwards. Seventy-five percent of the rapid deepening cases fell in the interval between July and November with the highest probability of rapid deepening appearing in September and November. Track segments of typhoons considered showed maximum deepening was predominant prior to recurvature and was primarily a feature occurring from 155E to the Philippine archipelago between latitudes of 10N and 20N with local maxima of initial rapid deepening in the west central Philippine Sea and just east of the Marianas.

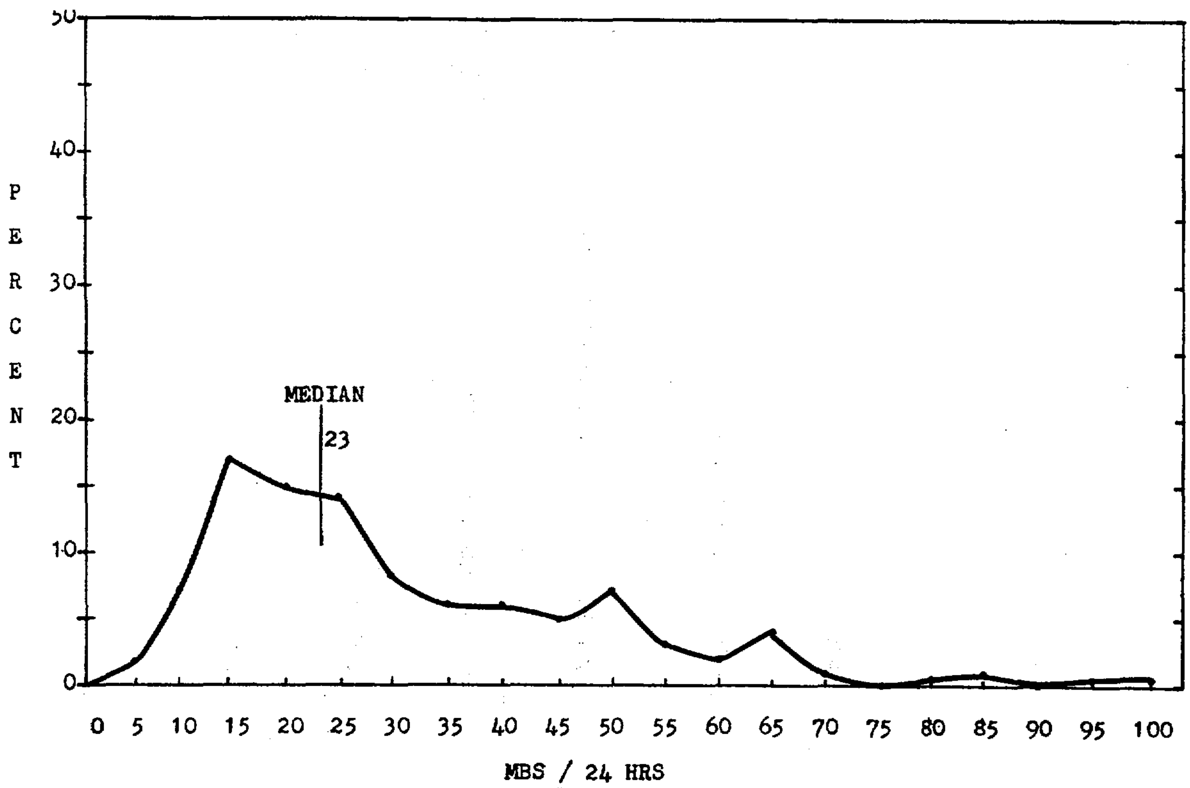

Figure 3-3. Frequency Distribution of Maximum 24 Hour Deepening of Typhoons, 1956-1971, 255 cases.

TABLE 3-5. MAXIMUM 24-HR DEEPENING (MB) OF TYPHOONS 1956-1971

YEAR	≥30	<30	<30 >30	NOT USED	ALL
1971*	10	11	21	4	25
1970	7	5	12	-	12
1969	8	5	13	-	13
1968	10	10	20	-	20
1967	6	11	17	3	20
1966	2	16	18	2	20
1965	6	10	16	5	21
1964	6	15	21	5	26
1963	6	10	16	3	19
1962	4	15	19	5	24
1961	4	7	11	9	20
1960	1	10	11	8	19
1959	9	6	15	2	17
1958	7	11	18	2	20
1957	6	9	15	3	18
1956	3	9	12	6	18
TOTAL	95	160	255	57	312
% OF TOTAL TYPHOONS	37%	63%	82%	18%	100%

*Includes Kit (Jan 1972)

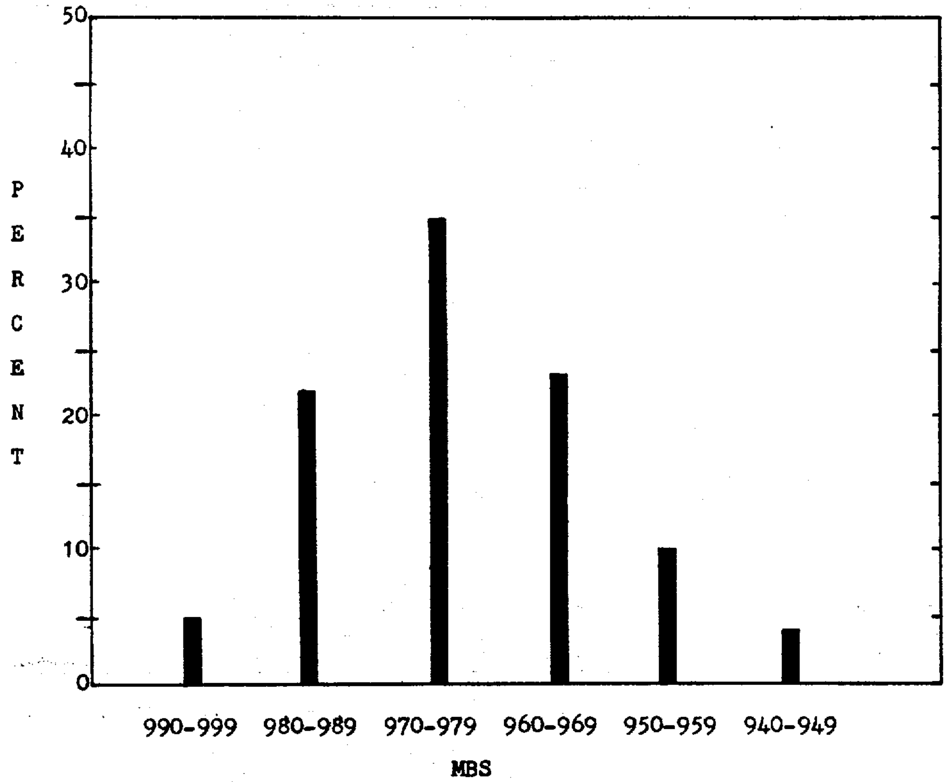

Figure 3-4. Frequency Distribution of Central Pressure for the Onset of Rapid Deepening (⩾30 mb/24 hour), 1956-1971, 95 cases.

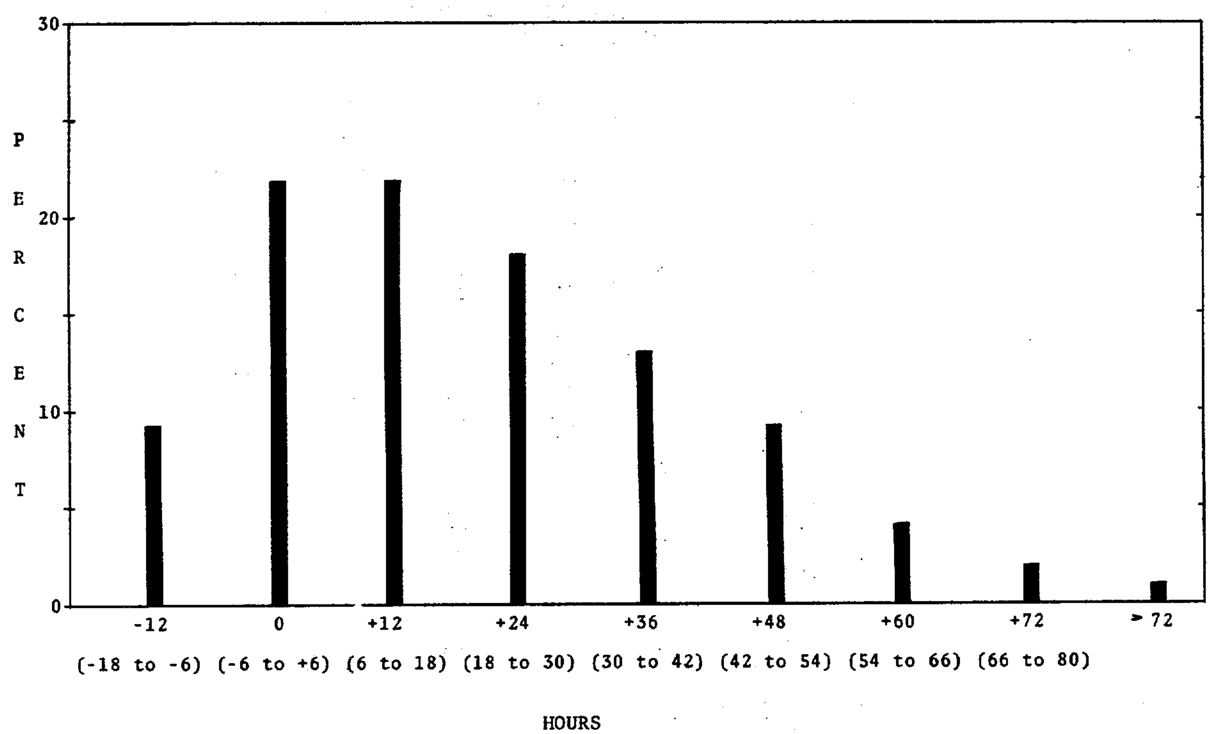

Figure 3-5. Frequency Distribution for Initial Point of Rapid Deepening (⩾30 mb/24 hour) Compared to Onset of Typhoon Force Winds, 1956-1971, 95 cases.

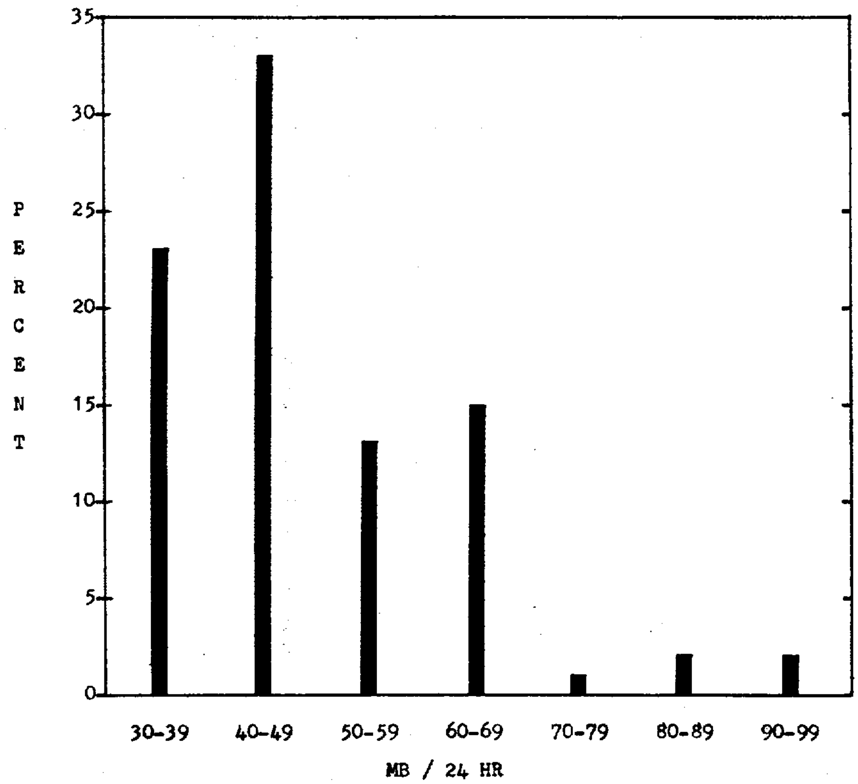

Figure 3-6. Frequency Distribution of Cases of ⩾30 mb (10-mb intervals), 1956-1971, 95 cases.

TABLE 3-6. RAPID DEEPENING (⩾30 MB) OF TYPHOONS 1956-171 FOR 12- AND 6-HR PERIODS

YEAR	12 HR ⩾30 MB	6 HR ⩾30 MB
1971*	6	1
1970	4	-
1969	-	-
1968	3	-
1967	3	-
1966	1	2
1965	1	-
1964	3	-
1963	2	-
1962	2	-
1961	2	-
1960	1	-
1959	4	-
1958	4	1
1957	4	-
1956	-	-
TOTAL	40	4
% OF ⩾30 MB/24 HR	42%	4%
% OF ALL SAMPLE	16%	2%

*Includes Kit, Jan 1972.

TABLE 3-7. MONTHLY VARIATIONS 1956-1971
OF TYPHOONS DEEPENING ≥30 MB/24 HR

MONTH	≥30 MB/24 HR	TOTAL TYPHOONS OCCURRING IN MONTH	RATIO
JAN*	1	5	
FEB	0	1	
MAR	1	3	
APR	4	14	
MAY	1	15	
JUN	5	19	
JUL	10	46	22%
AUG	18	65	28%
SEP	23	56	41%
OCT	12	45	27%
NOV	15	29	52%
DEC	4	10	

*Includes Kit, 1972.

Note: Ratio computed only for months with total typhoon count of ≥25.

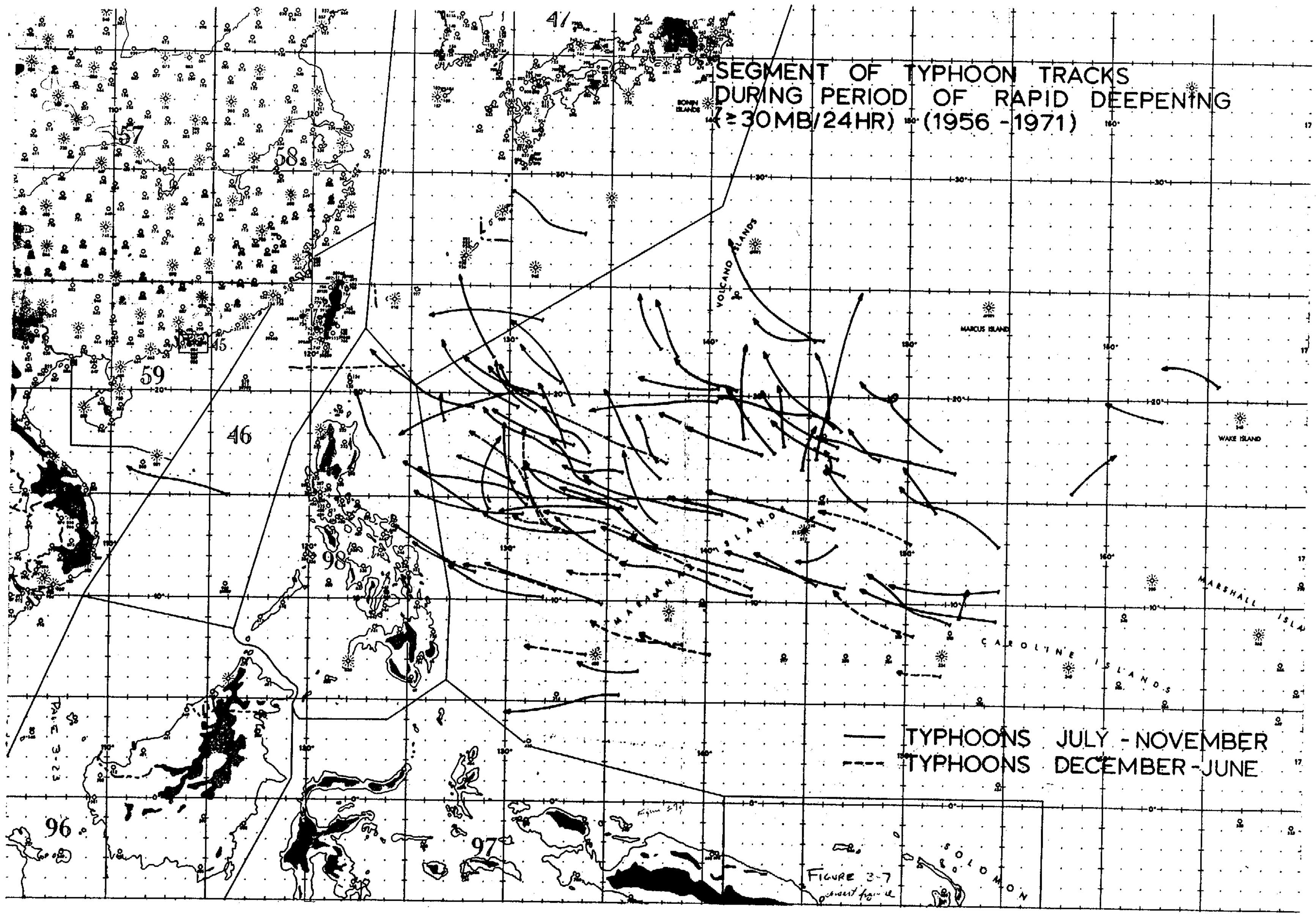
SEGMENT OF TYPHOON TRACKS
DURING PERIOD OF RAPID DEEPENING
(≥30MB/24HR) (1956 - 1971)
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANA ISLANDS
CAROLINE ISLANDS
MARSHALL ISLANDS
SOLOMON
BONIN ISLANDS
TYPHOONS JULY - NOVEMBER
TYPHOONS DECEMBER - JUNE
57
58
59
45
46
47
96
97
98
Figure 3-7

Figure 3-7.

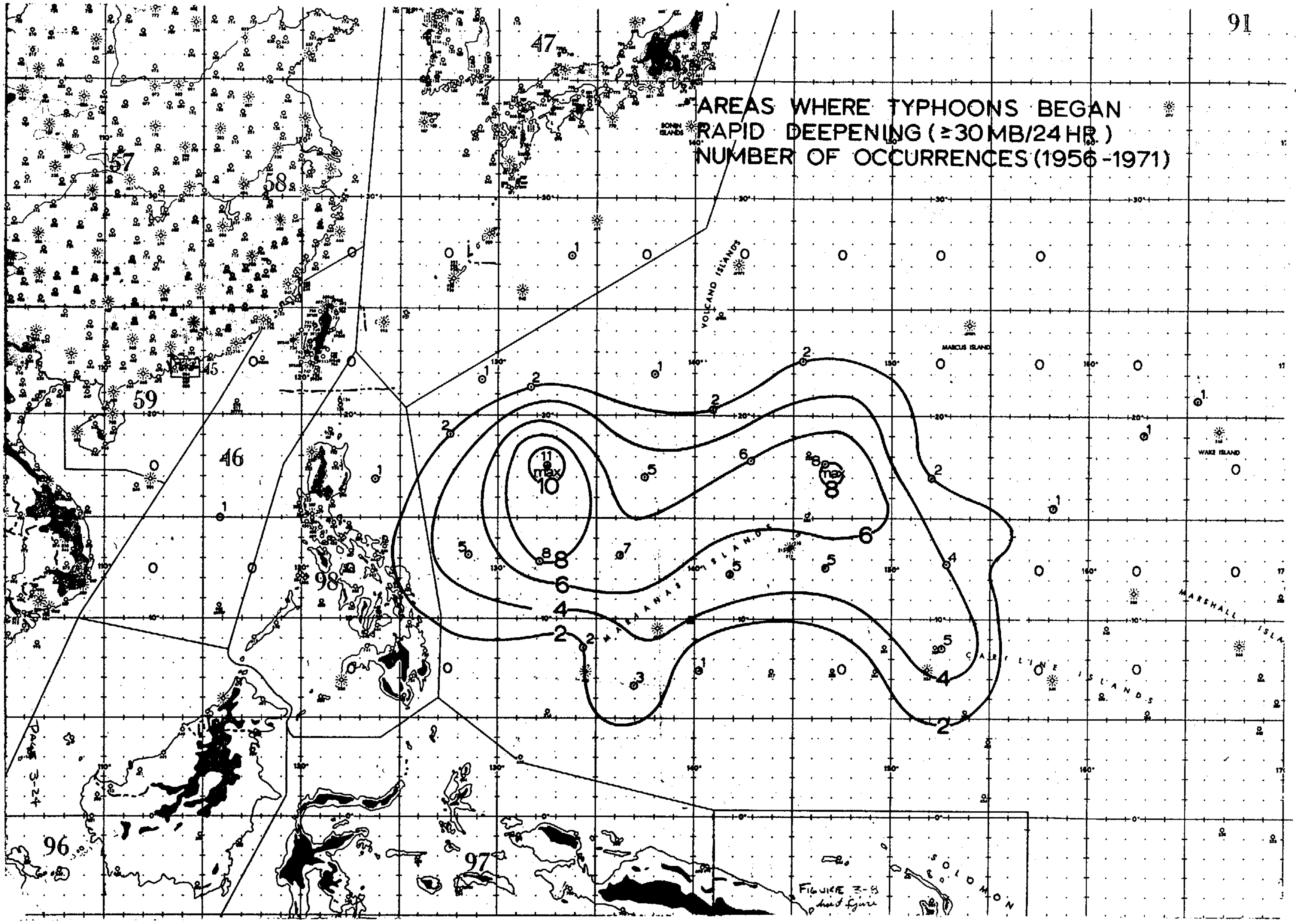
91
AREAS WHERE TYPHOONS BEGAN
RAPID DEEPENING (≥30 MB/24 HR)
NUMBER OF OCCURRENCES (1956-1971)
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
MARSHALL ISLANDS
CAROLINE ISLANDS
SOLOMON
max
10
max
8
6
4
2
47
57
58
59
46
45
98
96
97
Figure 3-8
Page 3-24

Figure 3-8.

F. COMPARISON OF OBJECTIVE TECHNIQUES

1. GENERAL

Verification of objective forecasting techniques has been continuous since 1967 although year-to-year modifications and improvements have prevented any long period comparison of more than a few of the techniques. None of the objective forecasts used now go beyond the simple steering concept of a point vortex in a smoothed flow field with adjustments based on past movement. Development and its important relationship to movement are excluded in all objective forecasts.

TYFOON, a new statistical analog technique for western Pacific typhoons (Jarrell and Somervell, 1970) that closely resembles HURRAN, its Atlantic counterpart (Hope, et al 1970), was first tested during the 1970 season. While designed as a forecast aid, verification is presented here along with the other objective techniques. This technique provides objective forecasts out to 72 hours.

2. DISCUSSION OF OBJECTIVE TECHNIQUES

a. EXTRAPOLATION - Past 12-hour movement is extrapolated to 24 and 48 hours.

b. ARAKAWA (1963) - Grid overlay values of surface pressure are entered into regression equations and hand-computed for storms 50 kt or greater.

c. HATRACK 700 mb, 500 mb (Hardie, 1967) - Point vortex advected on the 700 mb and 500 mb analysis or prognostic SR (space mean) field in six-hour time steps up to forecast period of 66 hours (without bias correction).

d. RENARD 700/500 - This technique is basically the HATRACK scheme with an adjustment to correct for recent errors extrapolated into the future. This "bias adjustment" is similar to that proposed by Renard et al (1970) except no limits are imposed on the bias growth rate.

e. TYRACK - Tropical cyclone movement forecast on FWC Pearl tropical fields (Hubert, 1968) with capability for subjective program control. This technique will no longer be available at JTWC since the FLEWEACEN Pearl Harbor streamline fields are being replaced with the FLENUMWEACEN Monterey Global Band field and there are no current plans to redesign the TYRACK program to operate on these fields.

f. TYFOON (Jarrell and Somervell, 1970) - Program outputs forecast positions as the centers of probability ellipses out to 72 hours based on a group of analog storms which occurred within a time/space envelope centered about the date and position of the storm being forecast. Ellipses are based on the analog population weighted according to similarity to the existing storm.

3. TESTING AND RESULTS

Table 3-8 presents a homogeneous comparison of all techniques used. The official JTWC forecast is included for comparison in those cases where at least one objective technique was used. The comparison reveals that the TYFOON program (weighted climo) is superior to all existing techniques. There is currently at JTWC a research effort underway to systematically examine all aspects of TYFOON in an effort to eliminate known limitations to this program. Some modifications to TYFOON will probably be instituted before the main 1972 season.

TABLE 3-8. OBJECTIVE TECHNIQUES VERIFICATION

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X

24-HOUR

	JTWC	XTRP	ARKW	HT7P	HT5P	RD7M	RD5M	TYRK	CLIW
JTWC	577 109 109 0								
XTRP	427 99 118 19	429 118 118 0							
ARKW	57 79 102 23	54 104 105 1	57 102 102 0						
HT7P	89 104 232 129	78 110 236 125	23 110 230 120	89 232 232 0					
HT5P	89 103 233 130	77 108 239 132	22 112 222 110	86 232 234 3	89 233 233 0				
RD7M	60 104 127 23	53 110 114 4	18 110 109 -1	60 230 127 -103	59 234 127 -107	60 127 127 0			
RD5M	63 102 128 27	55 108 119 11	20 110 104 -6	61 230 131 -99	62 237 129 -108	60 127 132 5	63 128 128 0		
TYRK	213 96 133 37	188 104 130 26	43 97 118 21	76 224 133 -91	75 227 134 -93	50 127 125 -3	52 128 126 -2	213 133 133 0	
CLIW	146 98 104 5	114 108 100 -8	28 94 95 1	41 235 113 -122	41 236 112 -125	26 126 113 -13	29 128 108 -20	105 143 107 -36	150 104 104 0

JTWC - OFFICIAL JTWC SUBJECTIVE FORECAST
XTRP - EXTRAPOLATION
ARKW - ARAKAWA
HT7P - HATRACK 700 MB PROG
HT5P - HATRACK 500 MB PROG
RD7M - RENARD MOD TO HATRACK 700
RD5M - RENARD MOD TO HATRACK 500
TYRK - TYRACK
CLIW - TYFOON (WEIGHTED CLIMO)

48-HOUR

	JTWC	XTRP	ARKW	HT7P	HT5P	RD7M	RD5M	TYRK	CLIW
JTWC	375 208 208 0								
XTRP	283 195 246 50	293 246 246 0							
ARKW	40 157 245 88	36 221 247 26	40 245 245 0						
HT7P	60 180 419 239	57 236 419 183	18 251 376 124	63 415 415 0					
HT5P	63 179 386 207	60 230 387 157	19 247 341 94	62 411 383 -29	66 382 382 0				
RD7M	37 178 240 62	35 242 244 2	14 251 206 -45	38 379 239 -140	38 359 239 -121	38 239 239 0			
RD5M	41 169 222 52	39 231 218 -13	16 250 190 -60	39 380 226 -154	42 357 220 -137	38 239 227 -11	42 220 220 0		
TYRK	156 186 307 121	141 225 310 85	31 239 288 49	52 401 290 -110	55 365 296 -69	31 251 268 17	35 219 291 72	164 314 314 0	
CLIW	110 189 207 19	90 214 205 -8	22 222 182 -40	30 435 218 -217	31 376 218 -158	18 263 222 -41	20 216 218 2	85 342 217 -125	126 209 209 0

72-HOUR

	JTWC	CLIW
JTWC	122 314 314 0	
CLIW	47 280 306 27	89 301 301 0

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CHAPTER 4

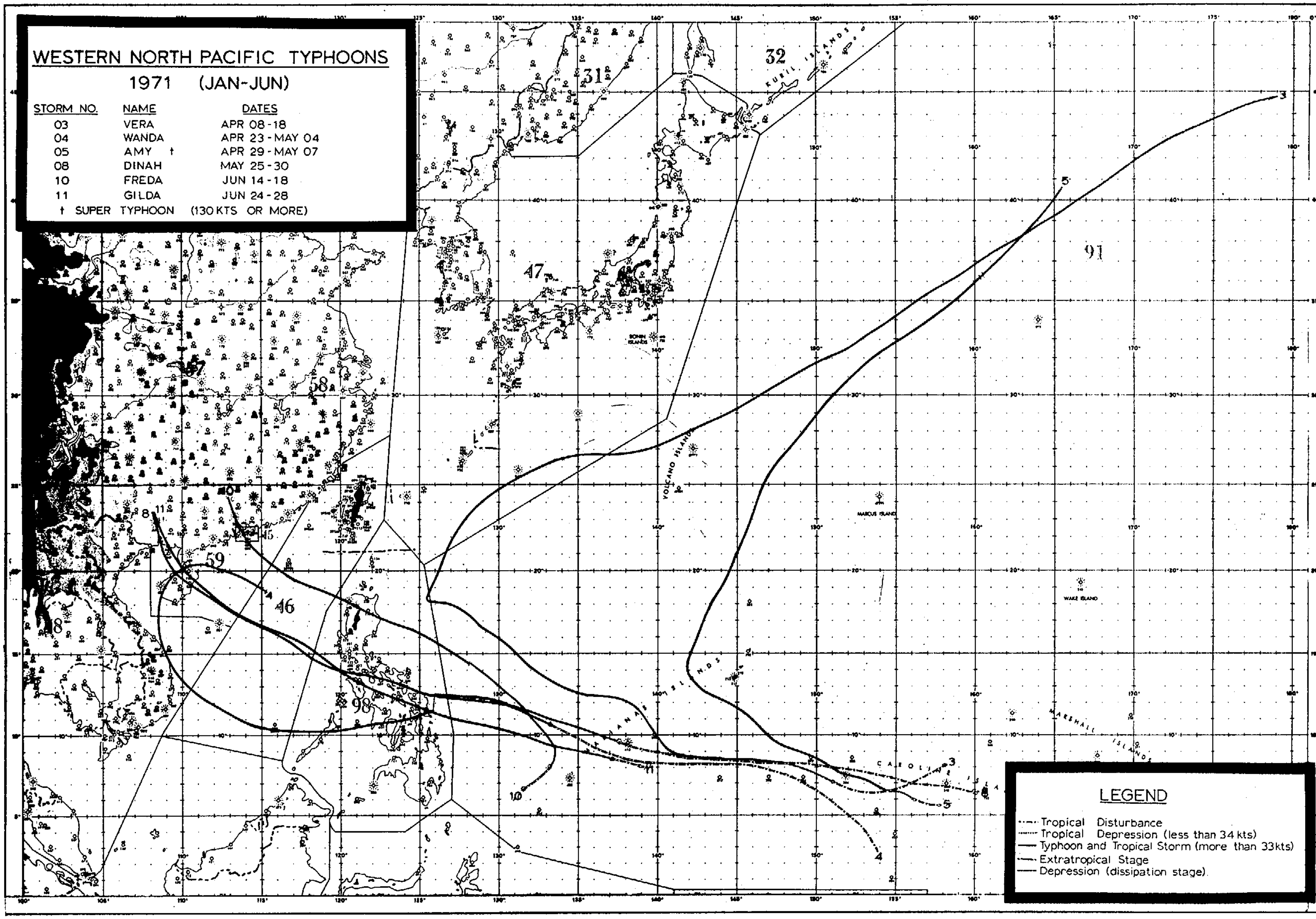
SUMMARY OF TROPICAL CYCLONES 1971

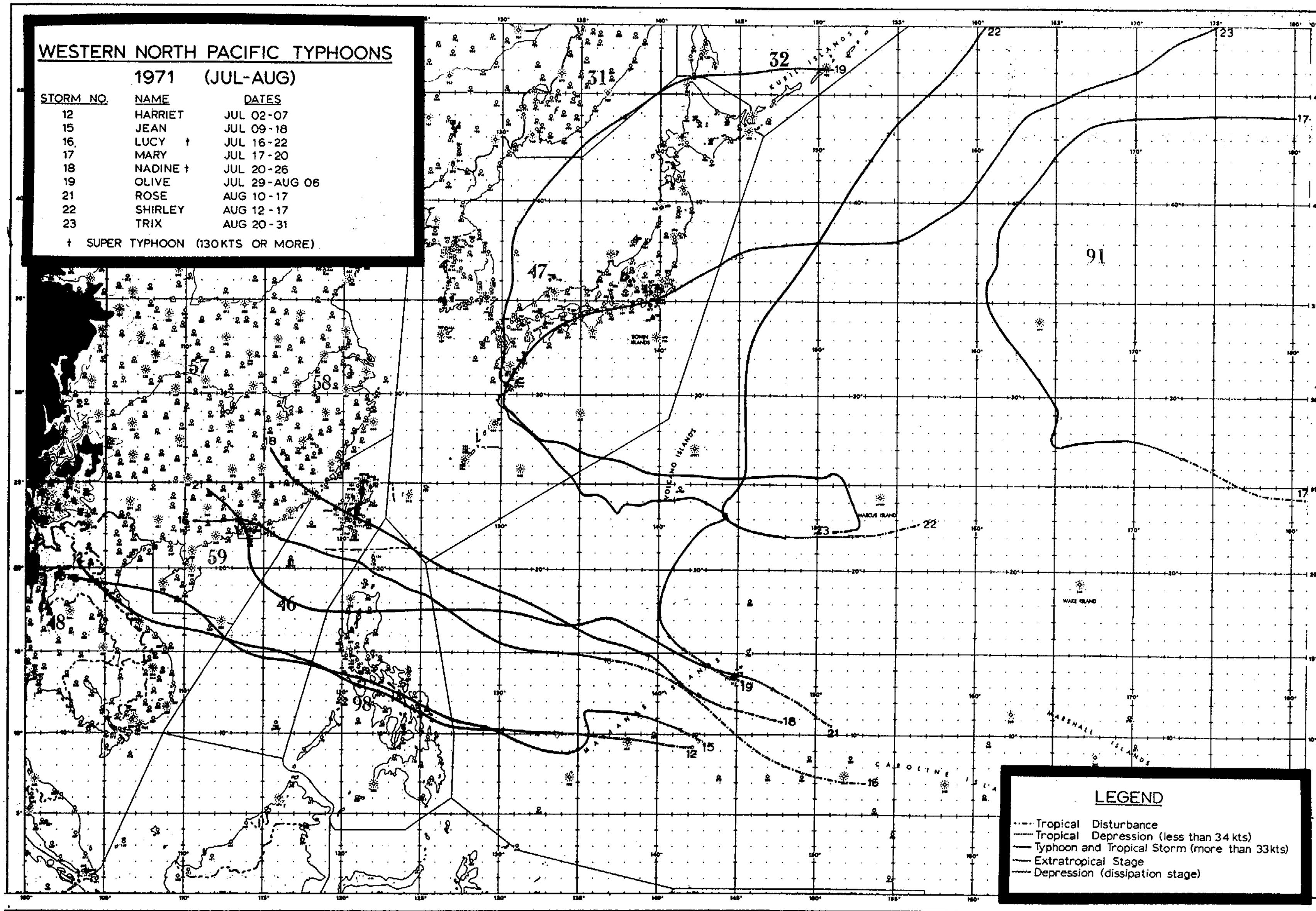
TABLE 4-1. SUMMARY OF WESTERN PACIFIC TROPICAL CYCLONES OF 1971

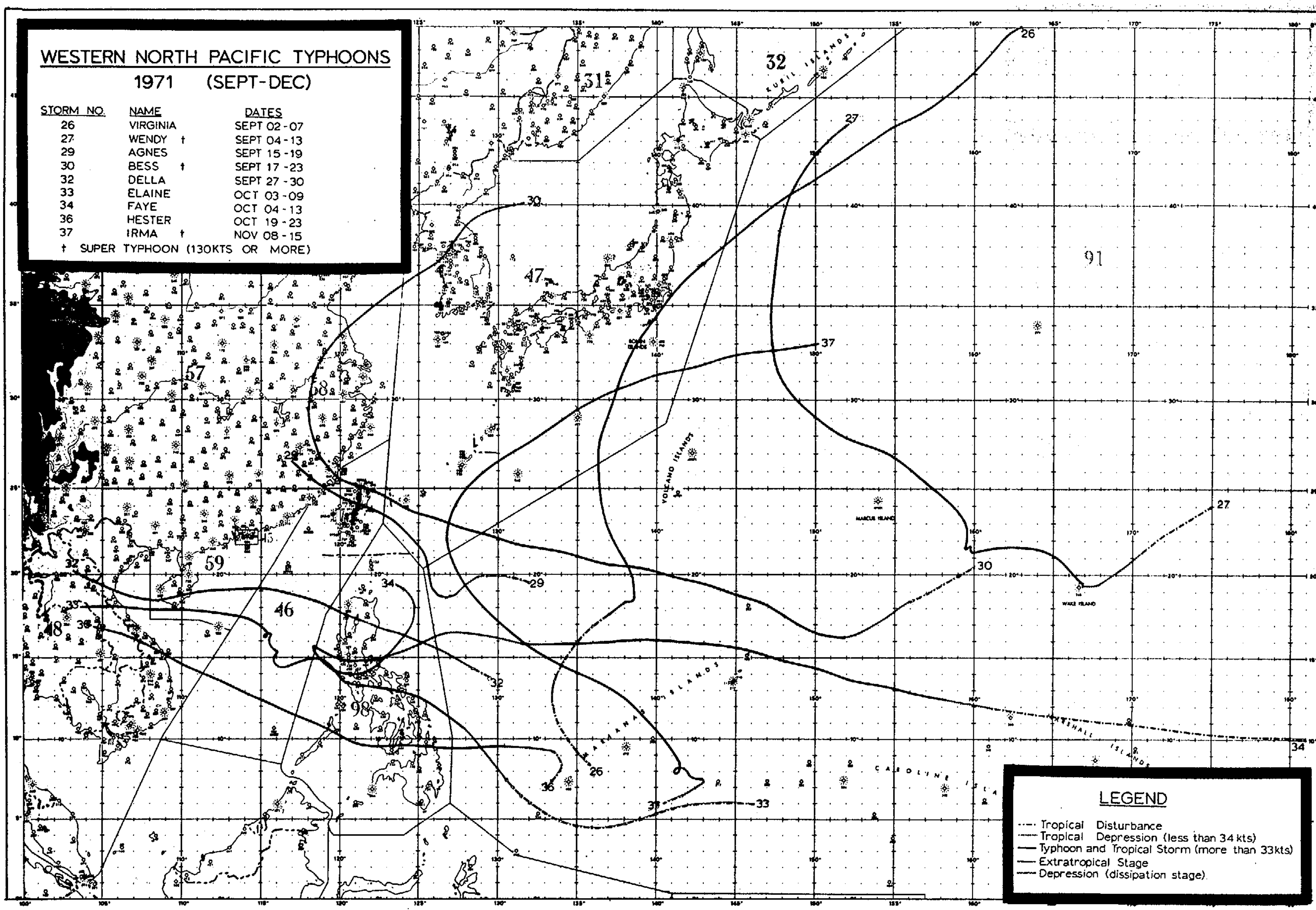
	1960-1970 (AVG)	1969	1970	1971
TOTAL NUMBER OF WARNINGS	730	430	533	747
CALENDAR DAYS OF WARNING	150	108	127	163
NUMBER OF WARNING DAYS WITH TWO OR MORE CYCLONES	54	15	29	54
NUMBER OF WARNING DAYS WITH THREE OR MORE CYCLONES	13	1	0	6
TROPICAL DEPRESSIONS	6	4	3	2
TROPICAL STORMS	10	6	12	11
TYPHOONS	19	13	12	24
TOTAL TROPICAL CYCLONES	35	23	27	37

TABLE 4-2. SUPER TYPHOONS DURING 1971

CYCLONE NUMBER	NAME	INCLUSIVE DATES	MAX INTENSITY	MIN SLP	MIN 700 MB HT
05	AMY	29 APR-07 MAY	150 KT	895 MB	2169 M
16	LUCY	16 JUL-22 JUL	130 KT	915 MB	2295 M
18	NADINE	20 JUL-26 JUL	150 KT	898 MB	2185 M
27	WENDY	04 SEP-13 SEP	140 KT	915 MB	2338 M
30	BESS	17 SEP-23 SEP	140 KT	911 MB	2268 M
37	IRMA	08 NOV-15 NOV	155 KT	884 MB	2040 M


WESTERN NORTH PACIFIC TYPHOONS
1971 (JAN-JUN)
STORM NO. NAME DATES
03 VERA APR 08-18
04 WANDA APR 23-MAY 04
05 AMY † APR 29-MAY 07
08 DINAH MAY 25-30
10 FREDA JUN 14-18
11 GILDA JUN 24-28
† SUPER TYPHOON (130 KTS OR MORE)
LEGEND
Tropical Disturbance
Tropical Depression (less than 34 kts)
Typhoon and Tropical Storm (more than 33kts)
Extratropical Stage
Depression (dissipation stage).


WESTERN NORTH PACIFIC TYPHOONS
1971 (JUL-AUG)
STORM NO. NAME DATES
12 HARRIET JUL 02-07
15 JEAN JUL 09-18
16 LUCY † JUL 16-22
17 MARY JUL 17-20
18 NADINE † JUL 20-26
19 OLIVE JUL 29-AUG 06
21 ROSE AUG 10-17
22 SHIRLEY AUG 12-17
23 TRIX AUG 20-31
† SUPER TYPHOON (130 KTS OR MORE)
LEGEND
Tropical Disturbance
Tropical Depression (less than 34 kts)
Typhoon and Tropical Storm (more than 33kts)
Extratropical Stage
Depression (dissipation stage)
KURIL ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
CAROLINE ISLANDS
MARSHALL ISLANDS


WESTERN NORTH PACIFIC TYPHOONS
1971 (SEPT-DEC)
STORM NO. NAME DATES
26 VIRGINIA SEPT 02-07
27 WENDY † SEPT 04-13
29 AGNES SEPT 15-19
30 BESS † SEPT 17-23
32 DELLA SEPT 27-30
33 ELAINE OCT 03-09
34 FAYE OCT 04-13
36 HESTER OCT 19-23
37 IRMA † NOV 08-15
† SUPER TYPHOON (130KTS OR MORE)
LEGEND
Tropical Disturbance
Tropical Depression (less than 34 kts)
Typhoon and Tropical Storm (more than 33kts)
Extratropical Stage
Depression (dissipation stage)
VOLCANO ISLANDS
MARIANA ISLANDS
MARCUS ISLAND
WAKE ISLAND
CAROLINE ISLANDS
MARSHALL ISLANDS
KURIL ISLANDS

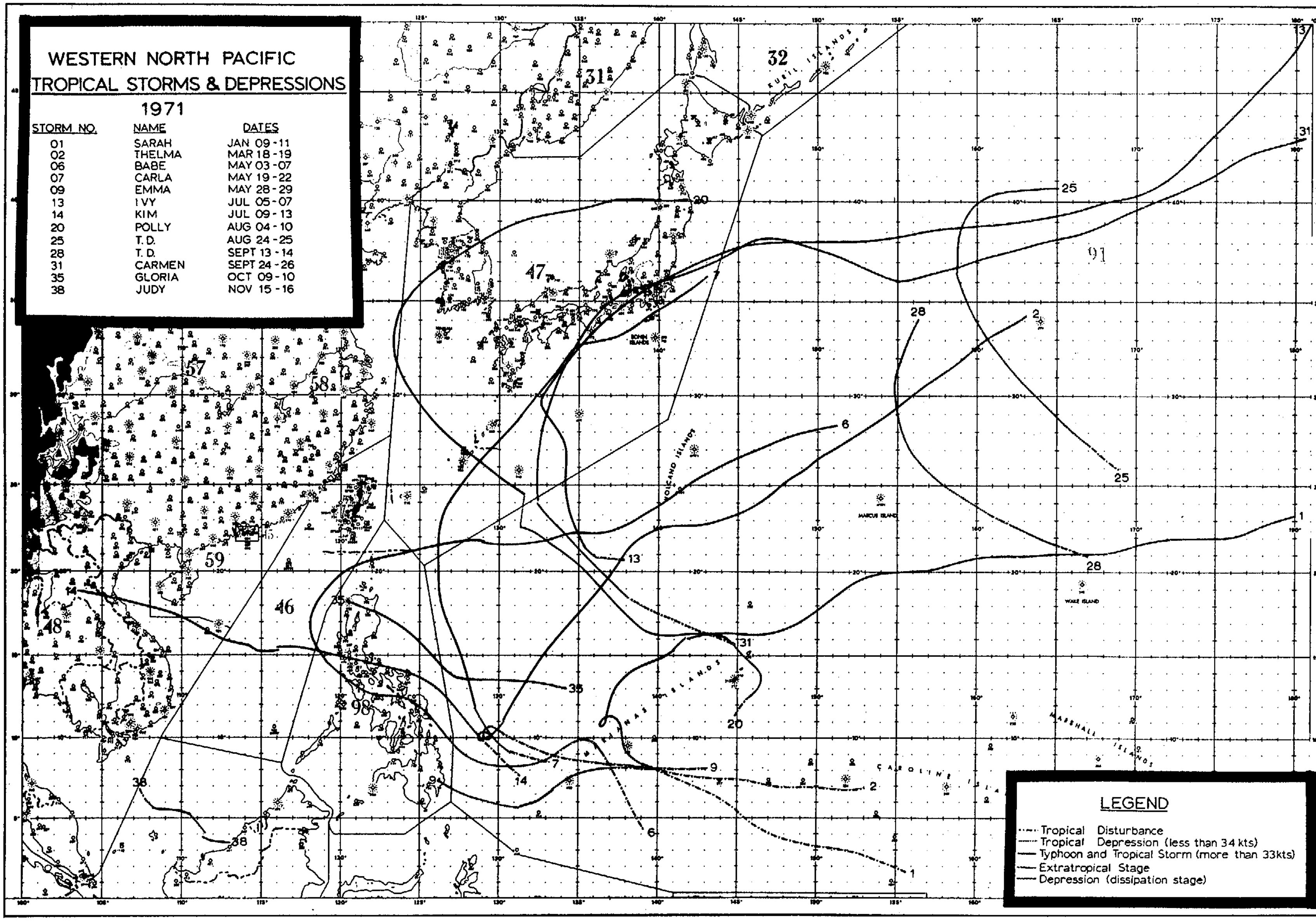

WESTERN NORTH PACIFIC
TROPICAL STORMS & DEPRESSIONS
1971
STORM NO. NAME DATES
01 SARAH JAN 09-11
02 THELMA MAR 18-19
06 BABE MAY 03-07
07 CARLA MAY 19-22
09 EMMA MAY 28-29
13 IVY JUL 05-07
14 KIM JUL 09-13
20 POLLY AUG 04-10
25 T.D. AUG 24-25
28 T.D. SEPT 13-14
31 CARMEN SEPT 24-26
35 GLORIA OCT 09-10
38 JUDY NOV 15-16
LEGEND
Tropical Disturbance
Tropical Depression (less than 34 kts)
Typhoon and Tropical Storm (more than 33kts)
Extratropical Stage
Depression (dissipation stage)
KURIL ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
CAROLINE ISLA
MARSHALL ISLANDS

TABLE 4-3. 1971 TROPICAL CYCLONES

CYCLONE	TYPE	NAME	DATE	CALENDAR DAYS OF WARNING	MAX SFC WIND*	MIN OBS SLP	WARNINGS ISSUED TOTAL	NO. AS TYPHOONS	DISTANCE TRAVELED*
01	TS	SARAH	09 JAN-11 JAN	3	50	989	10	0	558
02	TS	THELMA	18 MAR-19 MAR	2	45	992	6	0	320
03	T	VERA	08 APR-18 APR	10	90	960	33	15	1770
04	T	WANDA	23 APR-04 MAY	12	75	980	41	7	1653
05	T	AMY	29 APR-07 MAY	9	150	895	35	25	2568
06	TS	BABE	03 MAY-07 MAY	5	55	987	18	0	1278
07	TS	CARLA	19 MAY-22 MAY	4	50	989	15	0	996
08	T	DINAH	25 MAY-30 MAY	6	90	956	21	13	1386
09	TS	EMMA	28 MAY-29 MAY	2	35	1000	5	0	354
10	T	FREDA	14 JUN-18 JUN	5	65	978	15	8	858
11	T	GILDA	24 JUN-28 JUN	5	90	975	16	11	1308
12	T	HARRIET	02 JUL-07 JUL	6	125	921	20	11	1398
13	TS	IVY	05 JUL-07 JUL	3	60	978	11	0	1032
14	TS	KIM	09 JUL-13 JUL	5	50	984	18	0	1260
15	T	JEAN	09 JUL-18 JUL	10	85	968	32	17	2310
16	T	LUCY	16 JUL-22 JUL	7	130	915	26	13	1290
17	T	MARY	17 JUL-20 JUL	4	80	973	15	3	762
18	T	NADINE	20 JUL-26 JUL	7	150	898	27	20	1590
19	T	OLIVE	29 JUL-06 AUG	9	85	935	32	16	1554
20	TS	POLLY	04 AUG-10 AUG	7	40	985	21	0	1869
21	T	ROSE	10 AUG-17 AUG	8	120	950	29	23	1920
22	T	SHIRLEY	12 AUG-17 AUG	6	90	955	20	17	1392
23	T	TRIX	20 AUG-31 AUG	12	100	915	45	34	1866
24	TD	(TD 24 PICKED UP BY CENTRAL PACIFIC HURRICANE CENTER, HONOLULU)							
25	TD	25	24 AUG-25 AUG	2	30	996	6	0	300
26	T	VIRGINIA	02 SEP-07 SEP	6	100	955	23	7	978
27	T	WENDY	04 SEP-13 SEP	10	140	915	34	29	1986
28	TD	28	13 SEP-14 SEP	2	25	998	2	0	60
29	T	AGNES	15 SEP-19 SEP	5	75	975	17	4	606
30	T	BESS	17 SEP-23 SEP	7	140	911	26	21	1908
31	TS	CARMEN	24 SEP-26 SEP	3	50	1000	10	0	1284
32	T	DELLA	27 SEP-30 SEP	4	70	981	15	5	1068
33	T	ELAINE	03 OCT-09 OCT	7	100	963	26	15	1332
34	T	FAYE	04 OCT-13 OCT	8	65	984	25	3	2710
35	TS	GLORIA	09 OCT-10 OCT	2	45	987	7	0	444
36	T	HESTER	19 OCT-23 OCT	5	90	967	18	10	1488
37	T	IRMA	08 NOV-15 NOV	8	155	884	31	25	2280
38	TS	JUDY	15 NOV-16 NOV	2	45	1004	3	0	66
			1971 TOTALS	163**			533	251	

*Data Taken From Best Track
**Overlapping Days Included Only Once in Sum

GENERAL SUMMARY, WESTERN PACIFIC TYPHOON SEASON OF 1971

The western Pacific produced a total of 35 named tropical cyclones in 1971 which is 10 more than the climatological average and ranks with 1967 as the second highest total on record since 1945 (Table 4-4). Of this total, 24 reached typhoon intensity which ties with 1962 for the second largest number on record (Table 4-5). Only 1964, with a fairly similar monthly distribution, ranks higher with 26 typhoons. It is interesting to note that the number of typhoons in 1971 was only one short of the combined total of 1969 and 1970 typhoons.

One uncommon feature this year was the unusual activity during April and May in which 7 tropical cyclones occurred. Climatology indicates only two storms for the two-month period. On 3 and 4 May, three tropical storms, Wanda, Amy and Babe were in existence simultaneously.

Another month marked by heavy activity was July which produced 8 tropical storms, 5 of which developed to typhoon intensity, surpassing the previous high of 7 attained in 1967. To place the July figure in proper perspective, on the average only 8 named tropical cyclones are observed in the Atlantic during an entire year.

In contrast to 1970, the subtropical ridge was well developed and persistent throughout most of the typhoon season. This provided a synoptic pattern of trade-wind produced cyclonic wind shear and a mechanism for mass transport towards developing depression centers. Both are considered important environmental conditions for tropical cyclone development (Simpson, 1971).

Monthly mean values of 700-mb height anomalies for the west Pacific indicated positive values along the climatological position of the subtropical ridge. During June and July, positive anomalies of over 30 m were centered near the Ryukyu chain (Posey, 1971 and Wagner, 1971). This created an unusual synoptic regime for that time of year which steered storms on a westerly course into the South China Sea and also contributed to a drought condition on Okinawa. A succession of 6 tropical storms crossed the Philippine Islands into the South China Sea during mid-June to mid-July which is unparalleled for the early summer in the west Pacific.

The semi-permanent upper tropospheric mid-Pacific trough acted as an initiator of at least 25% of the 1971 typhoons. Circulations that later developed into typhoons

TABLE 4-4. FREQUENCY OF TROPICAL STORMS (INCLUDING TYPHOONS) BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	1	1	2	5	7	6	1	3	0	26
1946	0	0	1	0	1	2	3	2	3	1	2	0	15
1947	0	0	1	0	1	1	3	3	5	6	6	1	27
1948	1	0	0	0	2	2	2	5	5	4	3	2	26
1949	1	0	0	0	0	1	5	3	6	1	3	2	22
1950	0	0	0	0	1	2	3	2	3	3	3	1	18
1951	0	0	1	2	1	1	1	2	2	4	1	2	17
1952	0	0	0	0	0	3	3	4	5	6	3	4	28
1953	0	1	0	0	1	2	2	6	3	4	3	1	23
1954	0	0	1	0	1	0	1	6	4	3	3	0	19
1955	1	0	1	1	0	1	6	3	3	4	1	1	22
1956	0	0	1	2	0	1	2	5	5	2	3	1	22
1957	2	0	0	1	1	1	1	3	5	4	3	0	21
1958	1	0	0	0	1	3	5	3	3	3	2	1	22
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
Totals	12	7	13	20	30	42	104	137	125	102	71	30	691
Avg.	.44	.25	.48	.74	1.11	1.56	3.85	5.07	4.63	3.78	2.63	1.11	25.59

TABLE 4-5. FREQUENCY OF TROPICAL STORMS REACHING TYPHOON INTENSITY BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	0	0	1	2	5	3	1	1	0	13
1946	0	0	1	0	1	1	3	1	3	1	2	0	13
1947	0	0	0	0	1	1	0	3	4	5	4	1	19
1948	1	0	0	0	2	0	2	2	4	1	2	1	15
1949	1	0	0	0	0	1	3	3	3	1	1	1	14
1950	0	0	0	0	1	1	1	2	1	3	2	1	12
1951	0	0	1	2	1	1	1	2	2	3	1	2	16
1952	0	0	0	0	0	3	1	3	3	4	3	2	19
1953	0	1	0	0	1	1	2	4	2	4	1	1	17
1954	0	0	0	0	1	0	1	4	4	2	3	0	15
1955	1	0	1	1	0	1	5	3	3	2	1	1	19
1956	0	0	1	1	0	0	2	4	5	1	3	1	18
1957	1	0	0	1	1	1	1	2	5	3	3	0	18
1958	1	0	0	0	1	3	4	3	3	3	1	1	20
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
Totals	7	2	6	17	23	30	67	97	88	76	50	20	483
Avg.	.26	.07	.22	.63	.85	1.11	2.48	3.59	3.26	2.81	1.85	.74	17.89

Dinah, Mary, Shirley, Wendy, Trix and Bess originated from downward extensions of upper tropospheric cyclonic cells east of 150E during the months of May, July, August and September.

Six typhoons crossed the 130-kt threshold into the category of super typhoons. This closely matches the annual average (1959-70) of 5.8. The most intense storm of the year was typhoon Irma with winds in excess of 150 kt. A dropsonde measurement of 884 mb in the eye of Irma was the lowest central pressure measured in over a decade.* Super typhoons Lucy, Nadine and Wendy were the largest with their circulations dominating an area 600 n mi or more in radius and gale force winds extending outward for 300 n mi or more.

The most disasterous typhoon in 1971 was Rose which struck Hong Kong in August. Approximately 130 people were killed, 5,000 persons were left homeless and 28 ocean-going vessels were run aground or sunk. Hester, which struck the Vietnam coast near Chu Lai in October, was probably the most destructive storm in terms of U.S. military damage during the entire war.

As damage and casualty statistics are incomplete for the 1971 season, mention is made on an individual basis for each storm narrative. Figures were based on data from the following sources: Weather Bureau of the Republic of China; Royal Observatory of Hong Kong; Office of the High Commissioner, Trust Territory of the Pacific Islands; Casualty Returns, Liverpool Underwriters Association; Director of Meteorology, Republic of Vietnam; Japan Meteorological Agency; Weather Bureau of the Republic of the Philippines; and the Environmental Data Service, NOAA.

*A record-low pressure of 877 mb was measured in the eye of typhoon Ida - Sep 1958 (Jordan, 1959).

TABLE 4-6. TYPHOON DAYS 1959-1971

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL PER YEAR
1959	---	---	---	8	---	---	3	18	19	18*	10	18	94
1960	---	---	---	2	---	10	13	36*	---	23*	2*	12	98
1961	---	---	8	---	8	2	10*	15	23*	17*	6	6	95
1962	---	---	---	7	4	---	14*	37*	8	30*	19*	---	119
1963	---	---	---	4	5	15	11	23*	14*	24*	---	11	107
1964	---	---	---	---	7	5*	22*	18*	28*	14	11*	6	111
1965	2	---	---	2	5	12*	19*	23*	25*	14	6	---	108
1966	---	---	---	5	11	6	7*	16*	23*	11	4	3	86
1967	---	---	2	7	---	4	14*	10	32*	21*	21*	---	111
1968	---	---	---	6	1	7	6	8	32*	19	18*	---	97
1969	5	---	---	5	---	---	8	6	10	18	10*	---	62
1970	---	5	---	---	---	2	5	24*	16	21*	6	---	79
1971	---	---	---	4	13*	8	20*	27*	21*	11*	7	---	111
TOTAL	7	5	10	50	54	71	152	261	251	241	120	56	1278
MEAN	.54	.38	.77	3.8	4.2	5.5	11.7	20.1	19.3	18.5	9.2	4.3	98.3

*Two typhoons occurring on the same day are counted as two typhoon days.

TABLE 4-7. LIST OF ESTIMATED CASUALTIES
AND AFFECTED GEOGRAPHICAL LOCATIONS
FOR THE 1971 TYPHOON SEASON

NAME	DEATHS	MISSING	PRINCIPAL AREAS AFFECTED
SARAH	-	-	Remained over water
THELMA	-	-	Remained over water
VERA	-	-	Remained over water
WANDA	79	39	Philippines, Vietnam, Hainan Island
AMY	1	-	Truk District, Marianas
BABE	-	-	Philippines
CARLA	-	-	Ryukyus
DINAH	13	44	Philippines, Hainan Island, South China
EMMA	-	-	Remained over water
FREDA	7	-	Philippines, Hong Kong, South China
GILDA	1	-	Philippines, Hainan Island, South China
HARRIET	5	14	Philippines, Vietnam
IVY	1	-	Japan
KIM	-	-	Philippines, Vietnam
JEAN	-	-	Philippines, Hainan Island, Vietnam
LUCY	2	5	Philippines, Taiwan, Hong Kong, China
MARY	-	-	Remained over water
NADINE	32	25	Philippines, Taiwan, China, Japan
OLIVE	69	-	Japan
POLLY	-	-	Ryukyus
ROSE	130	-	Philippines, Hong Kong, China
SHIRLEY	-	-	Remained over water
TRIX	45	-	Bonin Island, Japan
VIRGINIA	56	-	Japan
WENDY	-	-	Wake Island
AGNES	1	5	Taiwan, China
BESS	32	6	Northern Marianas, Taiwan, China
CARMEN	20	-	Japan
DELLA	-	-	Philippines, Hainan Island, Vietnam
ELAINE	37	-	Philippines, Hainan Island, Vietnam
FAYE	3	-	Marianas, Philippines
GLORIA	10	80	Philippines
HESTER	91	2	Philippines, Vietnam
IRMA	-	-	Ryukyus
JUDY	-	-	Remained over water
TOTALS	635	220	

1971 TROPICAL STORM AND DEPRESSION
POSITION DATA

TROPICAL STORM SARAH

0500Z 9 JAN TO 1100Z 11 JAN

	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
090500Z	10.7N 137.8E	35	10.7N 137.9E	25	6	-10	13.7N 137.8E	45	125	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091100Z	11.1N 137.2E	40	11.4N 137.6E	30	29	-10	14.4N 137.3E	55	79	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091700Z	11.1N 136.7E	45	11.5N 136.9E	35	27	-10	13.6N 135.6E	55	208	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
092300Z	10.8N 136.8E	50	10.5N 136.5E	40	25	-10	11.3N 135.6E	55	344	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100500Z	11.8N 136.9E	50	11.7N 137.0E	50	8	0	15.5N 139.2E	60	100	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
101100Z	13.1N 137.5E	45	13.1N 137.4E	50	6	5	17.4N 140.7E	55	117	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
101700Z	14.4N 139.1E	40	14.3N 138.8E	50	18	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
102300Z	14.8N 140.3E	40	15.0N 140.8E	50	31	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
110500Z	15.2N 140.9E	35	15.2N 141.2E	35	17	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
111100Z	15.7N 141.7E	30	15.8N 141.5E	35	13	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM THELMA

0500Z 18 MAR TO 1100Z 19 MAR

	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
180500Z	10.2N 129.5E	45	9.9N 129.2E	45	25	0	10.6N 128.5E	60	137	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
181100Z	9.9N 128.8E	30	10.3N 128.6E	40	27	10	11.7N 127.3E	40	264	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
181700Z	9.2N 129.7E	25	10.2N 129.0E	40	73	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
182300Z	9.2N 129.8E	25	10.5N 129.6E	40	79	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
190500Z	11.6N 130.6E	25	12.5N 130.7E	40	54	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
191100Z	13.1N 131.6E	25	13.2N 132.2E	20	35	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM BABE

0000Z 3 MAY TO 0600Z 7 MAY

	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
030000Z	14.8N 119.0E	45	14.8N 119.0E	30	0	-15	15.9N 115.3E	45	171	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
030600Z	15.5N 118.5E	45	15.5N 118.5E	50	0	5	17.7N 116.3E	60	109	10	20.2N 114.6E	60	314	10	--.- ---.-	--	--	--
031200Z	16.0N 118.2E	50	16.1N 118.1E	50	8	0	18.5N 116.7E	60	98	15	21.1N 115.6E	55	342	5	23.9N 115.0E	25	801	-10
031800Z	16.4N 118.1E	50	16.2N 118.0E	50	13	0	17.8N 116.7E	60	126	15	19.6N 115.8E	60	422	10	--.- ---.-	--	--	--
040000Z	16.9N 118.1E	55	17.0N 118.0E	50	8	-5	18.9N 117.8E	60	87	15	21.7N 118.9E	60	335	15	24.4N 123.5E	40	550	15
040600Z	17.5N 118.2E	50	17.5N 118.2E	50	0	0	20.4N 119.6E	50	34	0	23.4N 123.9E	45	193	5	--.- ---.-	--	--	--
041200Z	18.2N 118.4E	45	18.2N 118.4E	45	0	0	20.9N 120.2E	40	86	-10	23.6N 124.9E	35	273	0	--.- ---.-	--	--	--
041800Z	18.7N 118.7E	45	18.9N 118.7E	40	12	-5	21.6N 121.0E	35	129	-15	24.1N 126.3E	35	332	5	--.- ---.-	--	--	--
050000Z	19.2N 119.3E	45	19.1N 119.1E	40	13	-5	21.3N 121.5E	35	189	-10	23.6N 126.6E	30	374	5	--.- ---.-	--	--	--
050600Z	20.3N 120.2E	50	20.3N 120.3E	50	6	0	22.6N 124.1E	40	161	0	24.6N 130.0E	30	304	10	--.- ---.-	--	--	--
051200Z	20.6N 121.7E	50	21.0N 121.6E	45	25	-5	23.6N 127.2E	35	171	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051800Z	20.9N 123.2E	50	21.4N 122.9E	45	34	-5	23.5N 128.7E	35	203	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060000Z	21.2N 124.9E	45	21.5N 124.2E	45	43	0	23.8N 130.3E	35	195	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	21.6N 126.8E	40	21.7N 126.6E	50	13	10	26.0N 134.2E	35	230	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	21.5N 129.3E	35	22.3N 129.2E	45	48	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	21.3N 131.5E	30	21.3N 132.0E	40	28	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	21.8N 133.1E	25	20.9N 134.6E	35	99	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070600Z	22.2N 134.9E	20	22.8N 135.8E	25	61	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM CARLA

0600Z 19 MAY TO 1800Z 22 MAY

	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
190600Z	14.0N 127.9E	45	14.5N 127.7E	40	32	-5	19.0N 128.1E	50	120	5	24.1N 131.6E	35	364	-10	--.- ---.-	--	--	--
191200Z	14.8N 127.7E	45	15.3N 127.6E	45	30	0	19.7N 128.4E	50	141	5	24.7N 132.1E	30	381	-10	--.- ---.-	--	--	--
191800Z	15.7N 127.4E	50	16.3N 127.6E	50	38	0	20.8N 129.1E	50	195	5	25.6N 133.2E	30	424	-5	--.- ---.-	--	--	--
200000Z	16.7N 127.0E	50	16.8N 127.0E	50	6	0	20.8N 127.7E	50	103	5	25.3N 132.5E	30	328	-5	--.- ---.-	--	--	--
200600Z	17.5N 126.7E	45	17.5N 126.6E	50	6	5	20.9N 126.5E	50	25	5	24.7N 130.9E	30	171	0	--.- ---.-	--	--	--
201200Z	18.3N 126.4E	45	18.4N 126.3E	45	8	0	22.3N 127.8E	35	106	-5	26.0N 133.0E	30	213	5	--.- ---.-	--	--	--
201800Z	19.0N 126.2E	45	18.9N 126.2E	40	6	-5	22.5N 128.0E	30	99	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210000Z	19.8N 126.2E	45	19.6N 126.0E	45	16	0	22.8N 128.5E	35	115	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210600Z	20.6N 126.2E	45	20.6N 126.5E	45	17	0	23.3N 131.2E	35	217	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
211200Z	21.5N 126.1E	40	21.4N 126.1E	35	6	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
211800Z	22.5N 126.2E	35	22.2N 126.1E	35	19	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
220000Z	23.8N 126.7E	35	23.8N 126.7E	35	0	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
220600Z	25.2N 127.8E	30	25.4N 127.6E	35	16	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
221200Z	26.7N 129.1E	25	26.6N 129.0E	30	8	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
221800Z	28.6N 131.2E	20	28.4N 131.1E	30	13	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM EMMA

1200Z 28 MAY TO 1200Z 29 MAY

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
281200Z	6.1N 132.4E	35	6.0N 132.6E	40	13	5	5.7N 128.7E	50	142	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
281800Z	5.8N 130.9E	30	6.1N 131.5E	40	40	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290000Z	5.9N 129.5E	25	5.2N 130.0E	35	51	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290600Z	6.3N 128.0E	25	5.9N 128.2E	25	27	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	7.0N 126.7E	25	6.0N 128.0E	20	98	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM IVY

0600Z 5 JUL TO 1800Z 7 JUL

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
050600Z	22.6N 134.8E	50	22.4N 134.8E	50	12	0	24.5N 133.5E	55	289	-5	26.6N 132.1E	60	469	10	--.- ---.-	--	--	--
051200Z	23.7N 134.5E	55	23.5N 134.7E	40	16	-15	27.1N 134.1E	50	177	-10	29.9N 133.6E	55	380	15	--.- ---.-	--	--	--
051800Z	26.1N 134.2E	55	24.8N 134.4E	45	78	-10	28.5N 133.9E	55	141	0	31.3N 133.9E	55	432	25	--.- ---.-	--	--	--
060000Z	28.3N 133.6E	60	28.3N 134.0E	55	21	-5	32.5N 134.7E	60	13	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	29.3N 132.8E	60	29.3N 132.8E	60	0	0	33.5N 131.7E	55	224	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	29.8N 132.7E	60	30.1N 132.6E	60	19	0	34.8N 132.2E	45	289	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	30.8N 133.3E	55	30.7N 133.0E	60	17	5	34.7N 134.5E	50	299	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	32.3N 134.8E	55	32.9N 134.4E	50	41	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070600Z	33.6N 136.2E	50	34.2N 135.3E	55	57	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
071200Z	35.0N 138.1E	40	35.1N 138.2E	45	8	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
071800Z	36.1N 140.4E	30	36.2N 140.2E	35	11	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM KIM

0600Z 9 JUL TO 1200Z 13 JUL

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
090600Z	13.3N 125.4E	20	13.3N 125.5E	30	6	10	14.7N 119.6E	45	99	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091200Z	14.3N 123.6E	20	13.8N 124.5E	30	60	10	14.7N 118.5E	40	117	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091800Z	14.6N 121.7E	20	14.0N 123.7E	30	121	10	14.7N 117.6E	45	115	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
00000Z	14.8N 119.7E	20	15.0N 119.5E	30	17	10	15.1N 112.7E	60	127	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
00600Z	15.3N 118.0E	25	14.9N 118.0E	30	24	5	15.2N 111.5E	60	157	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
01200Z	15.4N 116.6E	30	15.8N 115.8E	30	52	0	17.2N 108.5E	40	282	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
01800Z	15.3N 115.7E	35	15.7N 115.4E	30	29	-5	16.7N 108.8E	40	198	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
10000Z	15.2N 114.9E	40	15.3N 114.7E	40	13	0	15.6N 110.2E	50	87	5	17.0N 106.3E	35	72	-5	--.- ---.-	--	--	--
10600Z	15.5N 114.2E	50	15.3N 114.0E	50	17	0	15.6N 110.3E	60	78	15	16.6N 107.2E	50	129	15	--.- ---.-	--	--	--
11200Z	15.8N 113.2E	50	15.8N 113.2E	50	0	0	16.3N 109.7E	60	77	15	17.2N 106.4E	45	120	20	--.- ---.-	--	--	--
11800Z	16.1N 112.2E	45	15.9N 112.1E	50	13	5	16.6N 108.6E	60	82	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
20000Z	16.5N 111.4E	45	16.1N 111.2E	50	27	5	16.8N 107.7E	60	93	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
20600Z	16.9N 110.5E	45	16.7N 110.4E	55	13	10	17.8N 107.0E	60	74	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
21200Z	17.5N 109.2E	45	17.5N 109.2E	60	0	15	19.2N 105.7E	60	66	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
21800Z	17.8N 107.9E	45	17.9N 108.2E	60	18	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
30000Z	18.1N 106.8E	40	18.4N 107.3E	60	34	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
30600Z	18.3N 105.8E	35	18.2N 106.9E	60	63	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
31200Z	18.5N 104.8E	25	18.9N 105.4E	50	42	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM POLLY

0000Z 4 AUG TO 0000Z 10 AUG

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
40000Z	12.6N 145.9E	25	12.7N 146.0E	25	8	0	14.0N 145.2E	35	98	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
40600Z	13.4N 146.5E	30	12.8N 146.2E	30	40	0	13.5N 145.7E	35	195	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
41200Z	14.2N 146.1E	30	14.3N 146.4E	30	18	0	16.7N 144.3E	50	118	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
41800Z	14.8N 145.5E	30	14.8N 145.5E	30	0	0	16.9N 142.9E	50	119	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
50000Z	15.6N 144.8E	30	15.5N 144.6E	30	13	0	17.7N 142.0E	50	165	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
50600Z	16.2N 143.8E	30	16.4N 143.9E	30	13	0	18.7N 140.5E	50	158	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
51200Z	16.2N 142.3E	30	16.2N 142.3E	30	0	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
51800Z	16.1N 141.0E	30	16.4N 140.9E	30	19	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
60000Z	16.3N 139.5E	30	17.5N 140.0E	30	77	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
60600Z	17.2N 138.2E	25	16.5N 139.0E	25	62	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
71200Z	20.9N 134.3E	25	20.6N 134.5E	30	21	5	21.9N 131.7E	55	240	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
71800Z	21.6N 133.3E	25	20.8N 134.0E	35	62	10	22.3N 131.0E	65	293	25	24.1N 128.1E	80	481	40	--.- ---.-	--	--	--
80000Z	22.3N 132.0E	25	22.2N 132.3E	35	18	10	24.8N 129.0E	55	214	15	27.2N 126.1E	60	375	20	--.- ---.-	--	--	--
80600Z	24.6N 131.6E	40	22.9N 130.9E	50	109	10	25.5N 126.6E	60	203	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
81200Z	25.6N 130.0E	40	25.4N 130.3E	50	20	10	28.8N 124.8E	60	60	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
81800Z	26.6N 128.4E	40	26.8N 128.1E	50	20	10	31.3N 121.3E	40	128	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
90000Z	27.8N 126.8E	40	27.8N 126.7E	45	5	5	31.4N 120.9E	35	154	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
90600Z	28.8N 125.7E	40	29.2N 125.4E	40	29	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
91200Z	29.8N 124.7E	40	30.1N 124.6E	40	19	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
91800Z	31.2N 123.8E	40	31.3N 123.4E	40	21	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
00000Z	33.0N 123.3E	40	33.0N 122.4E	35	45	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL DEPRESSION 25

1200Z 24 AUG TO 1800Z 25 AUG

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
241200Z	27.7N 166.5E	25	26.0N 167.0E	30	105	5	26.0N 164.8E	45	239	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
241800Z	28.2N 165.8E	25	26.0N 166.5E	30	137	5	26.0N 166.5E	45	378	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250000Z	28.7N 165.2E	25	28.7N 165.2E	30	0	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250600Z	29.1N 164.7E	30	29.2N 165.0E	30	17	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251200Z	29.9N 163.8E	30	29.6N 164.7E	30	50	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251800Z	31.2N 162.4E	30	30.0N 162.8E	20	41	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL DEPRESSION 28

1800Z 13 SEP TO 0000Z 14 SEP

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
131800Z	25.9N 156.9E	25	21.0N 163.0E	30	444	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
140000Z	26.6N 156.2E	25	22.0N 161.0E	30	379	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM CARMEN

0600Z 24 SEP TO 1200Z 26 SEP

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
240600Z	18.7N 137.9E	25	18.3N 138.3E	30	33	5	19.7N 134.0E	45	214	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
241200Z	19.6N 136.7E	25	19.1N 137.5E	30	54	5	20.3N 133.3E	45	291	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
241800Z	20.7N 135.6E	25	21.0N 135.5E	25	19	0	23.2N 131.5E	40	318	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250000Z	21.9N 134.4E	25	23.9N 135.2E	30	127	5	27.1N 130.3E	45	343	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250600Z	23.2N 133.2E	30	23.0N 132.5E	25	40	-5	25.7N 127.2E	35	697	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251200Z	25.1N 132.4E	30	24.5N 132.4E	25	36	-5	28.8N 129.5E	35	643	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251800Z	28.4N 132.8E	35	29.0N 133.8E	35	63	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
260000Z	31.8N 134.1E	50	31.7N 134.2E	50	8	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
260600Z	34.4N 136.2E	45	34.1N 136.3E	50	19	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
261200Z	35.8N 139.2E	40	37.3N 140.5E	40	109	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM GLORIA

0600Z 9 OCT TO 1800Z 10 OCT

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
090600Z	13.8N 127.1E	40	13.6N 127.2E	45	13	5	14.1N 122.7E	60	177	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091200Z	14.5N 126.4E	40	13.7N 126.9E	45	56	5	14.0N 123.4E	60	217	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091800Z	15.3N 125.6E	40	14.8N 125.7E	45	30	5	16.7N 121.7E	50	87	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100000Z	16.1N 124.8E	45	16.1N 125.7E	40	52	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100600Z	16.9N 123.7E	40	17.4N 123.8E	40	30	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
101200Z	17.5N 122.4E	35	17.2N 122.6E	35	21	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
101800Z	18.0N 121.0E	30	17.6N 121.3E	30	29	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

TROPICAL STORM JUDY

1800Z 15 NOV TO 0600Z 16 NOV

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
151800Z	5.5N 109.5E	45	5.5N 108.6E	50	54	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160000Z	5.4N 110.0E	40	5.7N 108.8E	55	74	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160600Z	5.2N 110.5E	35	5.4N 110.7E	30	17	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

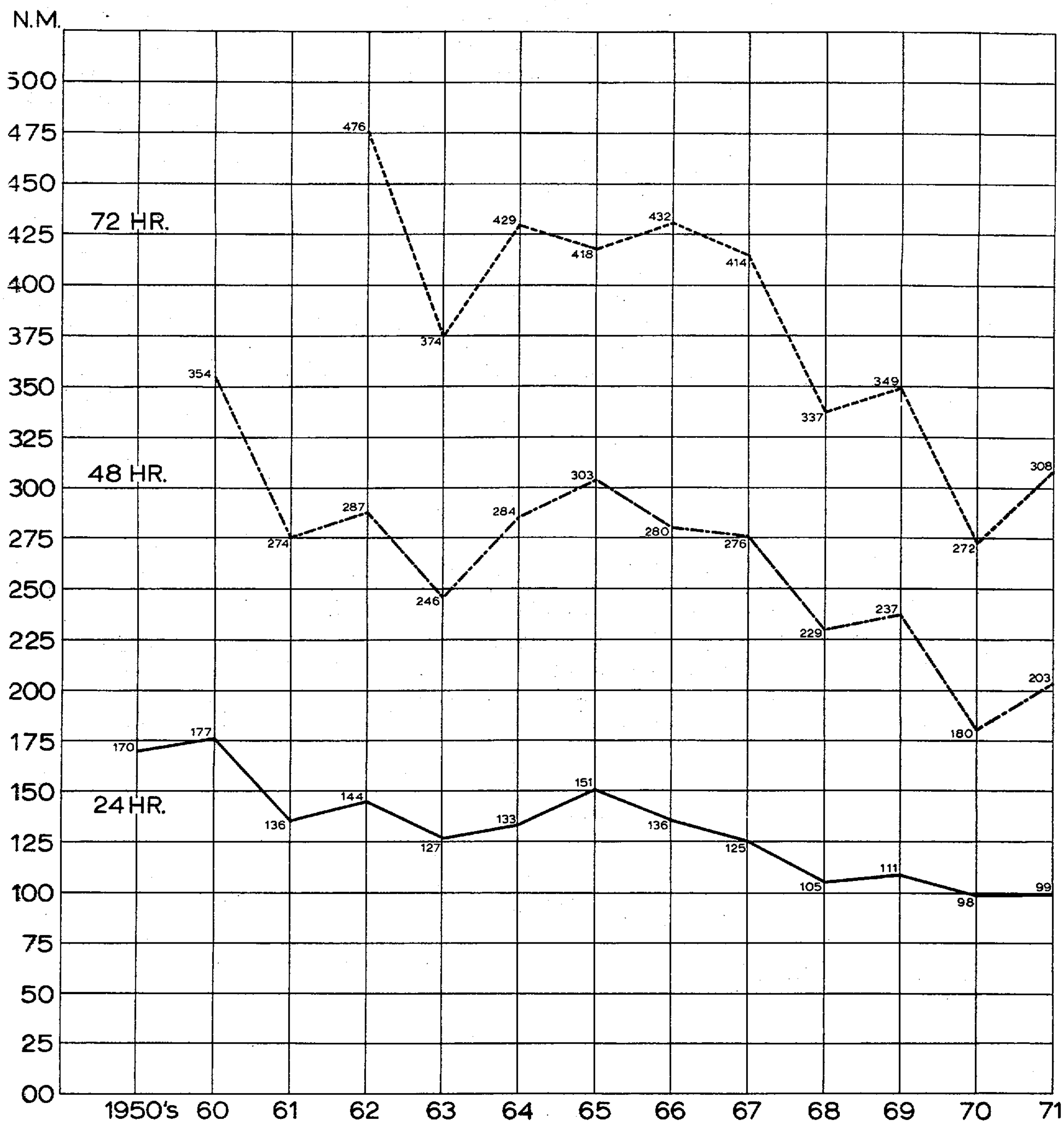


FIGURE 4-1. JTWC OFFICIAL FORECAST ACCURACY.

JTWC FORECAST VERIFICATION

Forecast positions for the 24-, 48-, and 72-hour forecasts are verified only as long as the best track analysis estimates winds in excess of 33 kt for tropical cyclones which reach typhoon intensity.

In addition to this method of verifying absolute error distance, a computation of closest distance to the best track (right angle error) has been included to indicate the demonstrated ability to forecast the path of motion without regard to speed.

The following tables and figures are presented to graphically depict the distribution of forecasting error in JTWC forecasts.

TABLE 4-8. AVERAGE FORECAST ERROR (NAUTICAL MILES)

	24 HR	48 HR	72 HR
1950-58	170	---	---
1959	*117	*267	---
1960	177	354	---
1961	136	274	---
1962	144	287	476
1963	127	246	374
1964	133	284	429
1965	151	303	418
1966	136	280	432
1967	125	276	414
1968	105	229	337
1969	111	237	349
1970	98	181	272
1971	99	203	308

*Forecast positions north of 35N were not verified.

TABLE 4-9. 1971 JOINT TYPHOON WARNING CENTER ERROR SUMMARY

(Average errors are given in nautical miles)

		WARNING			24 HOUR			48 HOUR			72 HOUR		
	CYCLONE	POSIT ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES
1.	T.S. SARAH	18	10	10	162	72	6	-	-	0	-	-	0
2.	T.S. THELMA	49	25	6	201	111	2	-	-	0	-	-	0
3.	T. VERA	19	15	33	122	81	25	204	133	17	229	189	6
4.	T. WANDA	16	8	40	67	36	36	134	68	24	187	62	8
5.	T. AMY	11	7	34	97	51	30	296	188	23	577	339	10
6.	T.S. BABE	23	17	18	142	98	14	321	165	9	675	279	2
7.	T.S. CARLA	15	8	15	125	112	9	313	188	6	-	-	0
8.	T. DINAH	19	15	20	63	47	17	162	100	11	178	95	4
9.	T.S. EMMA	46	20	5	142	22	1	-	-	0	-	-	0
10.	T. FREDA	16	11	15	62	38	11	93	32	7	126	28	2
11.	T. GILDA	16	10	16	86	62	12	199	143	8	236	180	2
12.	T. HARRIET	13	10	20	109	67	16	264	154	12	361	184	4
13.	T.S. IVY	25	17	11	205	80	7	427	52	3	-	-	0
14.	T.S. KIM	30	15	18	118	49	14	107	69	3	-	-	0
15.	T. JEAN	39	22	32	98	74	24	154	67	20	227	51	9
16.	T. LUCY	12	7	26	52	20	22	105	44	17	167	69	7
17.	T. MARY	42	35	15	181	126	11	179	108	7	-	-	0
18.	T. NADINE	15	9	27	63	34	23	107	41	14	142	36	5
19.	T. OLIVE	18	13	31	98	50	27	110	71	17	214	118	6
20.	T.S. POLLY	29	18	21	165	74	13	428	92	2	-	-	0
21.	T. ROSE	17	13	29	109	83	24	245	152	18	422	222	4
22.	T. SHIRLEY	29	18	20	208	112	16	525	321	12	942	672	4
23.	T. TRIX	15	9	43	83	51	39	149	107	32	253	200	14
24.					(CENTRAL PACIFIC HURRICANE CENTER)								
25.	T.D.	58	43	6	308	136	2	-	-	0	-	-	0
26.	T. VIRGINIA	22	17	23	94	65	19	217	152	13	382	250	5
27.	T. WENDY	16	9	33	126	74	29	241	160	24	364	258	10
28.	T.D.	412	384	2	-	-	0	-	-	0	-	-	0
29.	T. AGNES	24	19	17	127	94	13	201	102	3	-	-	0
30.	T. BESS	13	7	26	77	41	22	174	96	17	324	218	6
31.	T.S. CARMEN	51	39	10	418	145	6	-	-	0	-	-	0
32.	T. DELLA	30	22	15	73	60	12	123	78	8	142	62	2
33.	T. ELAINE	22	13	26	103	63	22	227	70	17	268	69	7
34.	T. FAYE	29	17	25	201	97	16	518	290	9	817	515	1
35.	T.S. GLORIA	33	20	7	160	125	3	-	-	0	-	-	0
36.	T. HESTER	17	10	18	120	41	13	265	103	8	495	131	2
37.	T. IRMA	14	9	31	98	50	27	194	78	21	251	123	7
38.	T.S. JUDY	48	38	3	-	-	0	-	-	0	-	-	0
	ALL FORECASTS	22	15	747	111	64	583	212	118	382	317	177	127
	*TYPHOONS	18	12	583	99	59	491	203	116	351	308	176	123

*Includes only forecasts on cyclones that became typhoons and only when verifying best track wind was ⩾ 35 Kts.

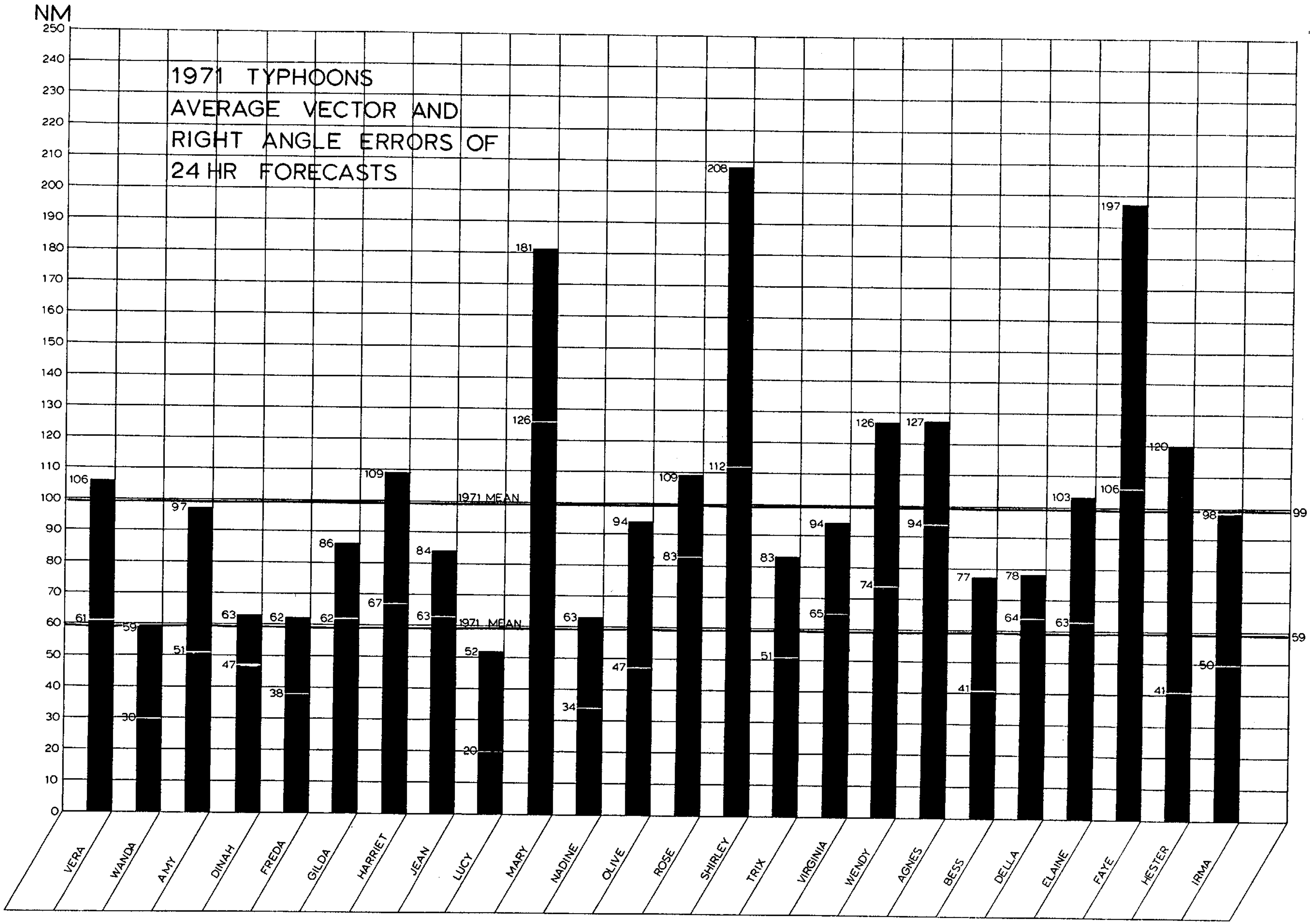


FIGURE 4-2. AVERAGE VECTOR AND RIGHT ANGLE ERRORS OF 24 HR FORECASTS.

RIGHT ANGLE ERROR

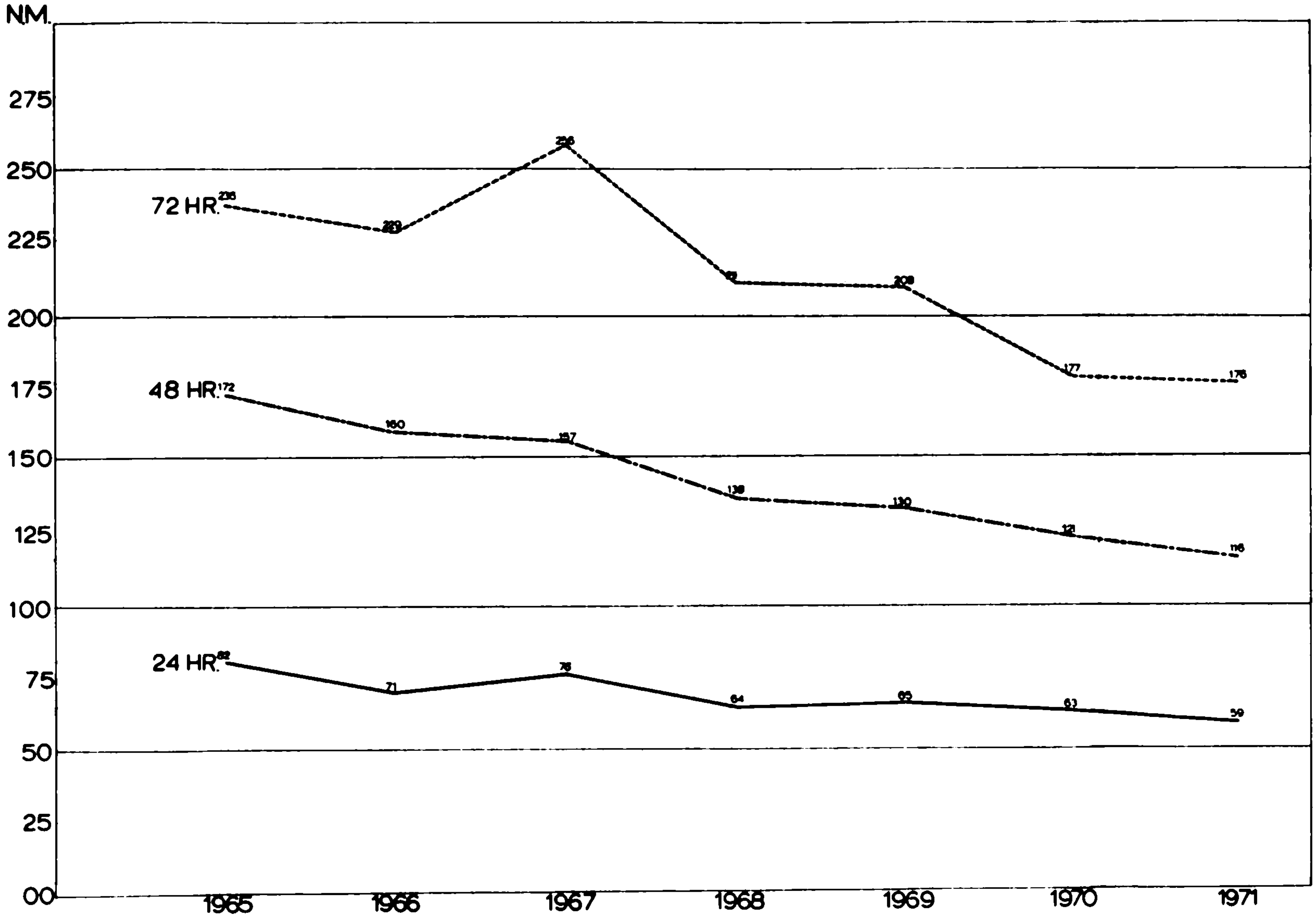


FIGURE 4-3. RIGHT ANGLE ERROR.

SUMMARY OF TROPICAL CYCLONE FORMATION ALERTS
1971

The Tropical Cyclone Formation Alert message, in its second year of use, provided JTWC with a means to adequately warn DOD activities of potentially dangerous tropical disturbances which normally had not reached the tropical depression stage.

During 1971 there were 48 tropical disturbances for which alerts were issued. The total number of alerts, including extensions was 90. Fifteen alert systems were not subsequently placed in warning status. Thirty-three of the 37 tropical cyclones placed in warning status during 1971 were initially covered by formation alerts.

SUMMARY

	NO. OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE
1970	32	18	27	56%
1971	48	33	37	69%

MONTHLY DISTRIBUTION

J	F	M	A	M	J	J	A	S	O	N	D
1	0	2	5	4	5	6	5	10	7	2	1

REFERENCES:

Jordan, C. L., "Reported Sea Level Pressure of 877 Mb," Monthly Weather Review, Vol. 87, No. 9, September 1959, pp 365-366.

Posey, J. W., "Weather and Circulation of June 1971--A Reversal of the Temperature Regime in Most of the United States," Monthly Weather Review, Vol. 99, No. 8, September 1971, pp 709-714.

Simpson, R. H., "A Reassessment of the Hurricane Prediction Problem," ESSA Technical Memorandum WBTM SR-50, February 1971, 16 pp.

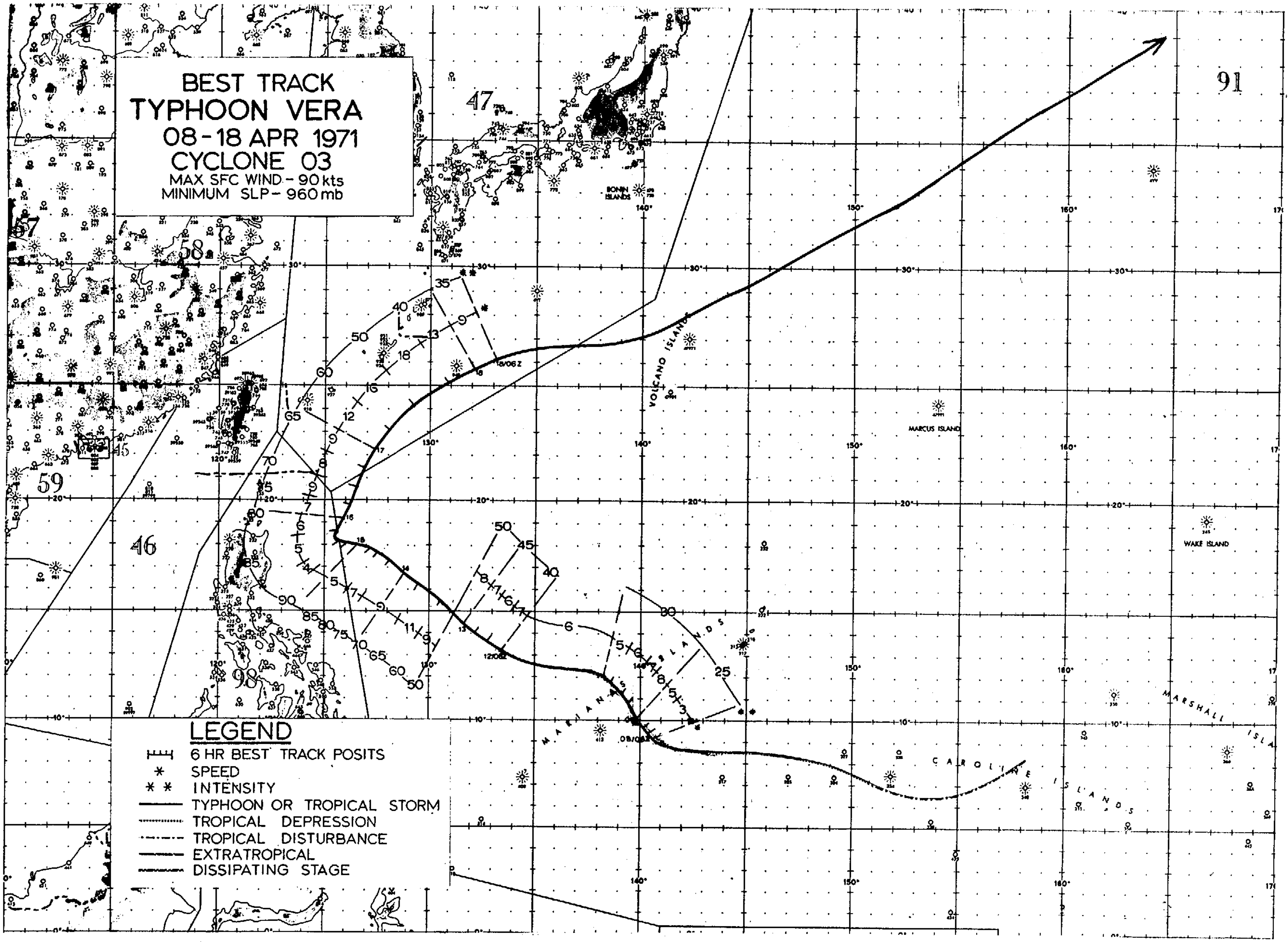
Wagner, J. A., "Weather and Circulation of July 1971--A Midmonth Circulation Reversal Accompanied by Drought-relieving Rains in Texas," Monthly Weather Review, Vol. 99, No. 9, October 1971, pp 800-806.

CHAPTER 5

INDIVIDUAL TYPHOONS OF 1971

NOTES: 1. All dates accompanying tracks are for 0000GMT unless otherwise denoted.

2. See last page of this chapter for definition of units and terms appearing herein.



BEST TRACK
TYPHOON VERA
08-18 APR 1971
CYCLONE 03
MAX SFC WIND - 90 kts
MINIMUM SLP - 960 mb
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
BONIN ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
CAROLINE ISLANDS
MARSHALL ISLA

VERA

A weak circulation on April 3rd was detected by island surface reports in the central Carolines marking the beginning stages of the season's first typhoon. The system drifted slowly into the Philippine Sea (Figure 5-1) becoming a tropical storm on the 12th while maintaining a west-northwest course of 8 kt. By early morning of the 14th, Vera developed sustained winds of 65 kt and began to slow in forward speed as she approached a weakness in the subtropical ridge. Taking a temporary westerly excursion at 5 kt, the typhoon reached its peak intensity of 90 kt approximately 250 n mi west of Escarpada Point on Luzon during the 15th (Figure 5-2). Early the following morning, Vera's course shifted abruptly to a northward drift as the high cell south of the Bonin Island chain strengthened. Her forward speed gradually increased on the 17th, and she diminished to tropical storm force that afternoon. Shifting to a northeast course, the storm paralleled the Ryukyu Island chain and accelerated to 18 kt becoming extratropical as she encountered the westerlies merging with a frontal zone south of Japan on the 18th.

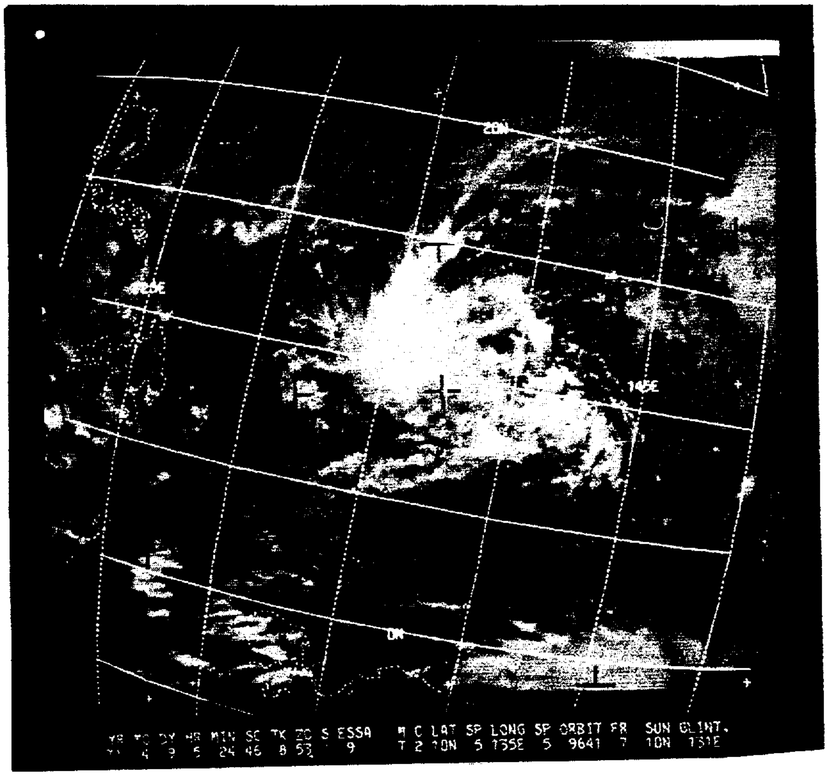


FIGURE 5-1. ESSA-9 PHOTO OF VERA AS A TROPICAL DEPRESSION ON 9 APRIL.

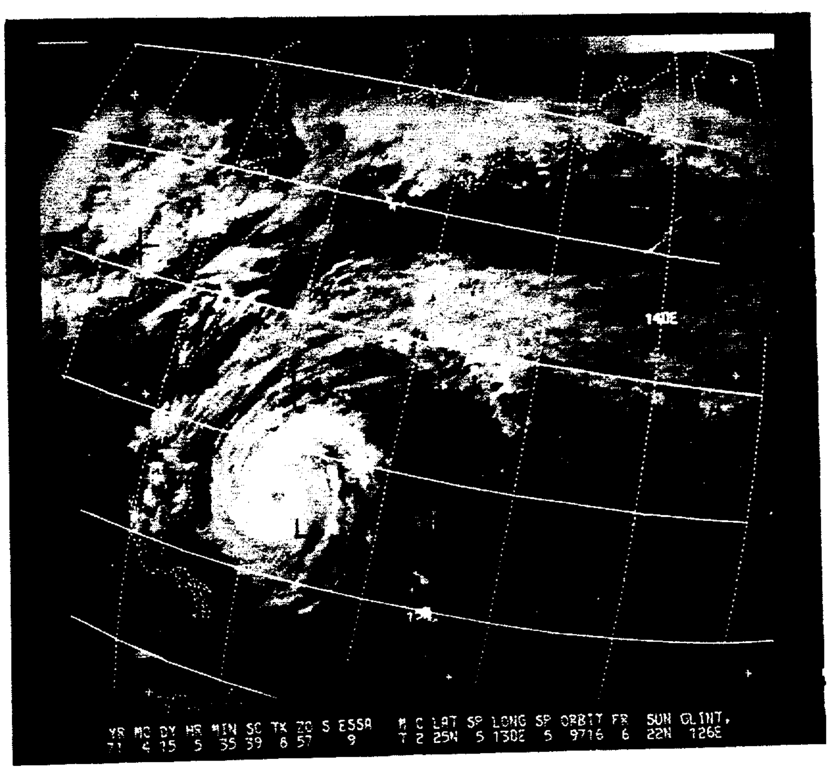


FIGURE 5-2. VERA EAST OF LUZON AS SEEN BY ESSA-9 ON 15 APRIL.

TYPHOON VERA

EYE FIXES FOR CYCLONE NO. 3

08 APR - 18 APR 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	070523Z	6.0N 142.0E	SATELIT---	STG B										HVY CLD MASS TO N	
														LTL CONV ACTIVITY	
2	080200Z	9.0N 140.8E	54-P------	-----	----	30	1008	----	--/--	----	-----	--	--	BROAD WIND CNTR-	
3	080426Z	7.0N 141.0E	SATELIT---	STG B										BRT CLD MASS TO W	
4	081206Z	10.0N 141.8E	VQ-P-30---	340M	----	20	1005	----	25/25	----	-----	--	--	NO RDR PRES	
5	081600Z	10.0N 141.6E	VQ-P-15---	310M	----	18	1006	----	25/25	----	-----	--	--	BAND TO NORTH	
6	082215Z	9.9N 139.6E	54-P- 1---	700MB	12	12	----	3082	13/12	----	-----	--	--	NO ORGANIZ ON RDR	
7	090345Z	11.2N 139.0E	54-P- 5---	700MB	28	30	1001	3079	13/--	----	-----	--	--	FB N AND W-SPIRAL	
														BAND OF SC IN CNT	
8	090525Z	10.0N 141.0E	SATELIT---	STG B										2ND CNTR 130NM NW	
9	090955Z	11.2N 139.0E	VQ-P- 3---	400M	28	20	1001	----	26/23	----	-----	--	--	NO RADAR PRES	
10	091615Z	11.6N 139.0E	VQ-P- 3---	400M	----	18	1000	----	25/22	----	-----	--	--	NO ORGANIZ ON RDR	
11	100340Z	12.0N 137.9E	54-P-20---	500M	20	25	998	3051	13/12	----	-----	--	--	POORLY DEF CNTR	
12	110527Z	9.5N 131.0E	SATELIT---	STG B											
13	120126Z	13.0N 134.1E	54-P- 5---	700MB	40	40	994	3015	13/13	----	-----	--	--	FIX AT SFC WIND	
														CNTR - WEAK BANDS	
14	120400Z	13.2N 133.4E	54-P- 5---	700MB	36	35	991	3002	13/12	CIRC		8	--	WIND CNTR - VERY	
														LTL RDR ORGANIZ	
15	120625Z	13.5N 133.0E	SATELIT---	STG C											
16	120944Z	13.4N 133.2E	VQ-P-15---	500M	26	30	986	----	26/23	----	-----	--	--	CNTR POORLY DEF	
17	121525Z	13.9N 132.5E	VQ-P- 5---	500M	45	40	987	2990	26/23	CIRC		55	--	CNTR POORLY DEF	
18	122230Z	13.7N 131.9E	54-R- 8---	-----	48	35	----	----	--/--	CIRC		25	--	EYE OPEN SW QUAD	13.8N 133.0E
19	122315Z	14.3N 131.7E	54-P- 5---	700MB	48	45	992	2990	13/10	CIRC		30	--	WC WEAK-OPEN W	
20	130330Z	14.6N 131.2E	54-P- 3---	700MB	70	50	989	2987	12/09	CIRC		35	--	WC REFORMING ALL	
														QUADS-MDT FBS	
21	130533Z	15.0N 130.5E	SATELIT---	STG C+										FNTL BAND TO NE	
22	131018Z	15.5N 130.7E	VQ-P- 5---	500M	----	45	980	----	26/23	CIRC		29	--	OPEN NE QUAD	
23	131502Z	16.2N 129.9E	VQ-P- 5---	500M	----	55	981	----	27/23	ELIP	E-W	38X28	22	WEST SEMIC POORLY	
														ORGANIZED	
24	132200Z	16.5N 128.8E	54-P- 3---	700MB	50	----	978	2871	15/13	CIRC		40	--	EYE OPEN NE QUAD	
														SFC CNTR WELL DEF	
25	140400Z	17.2N 128.1E	54-P- 5---	700MB	60	60	----	2868	18/12	CIRC		40	--	WK CLOSED WC	
26	140628Z	18.0N 128.0E	SATELIT---	STG X	DIA	3	CAT 4.0							RAGGED EYE	
														CLSD WC-STG FBS	
27	140959Z	17.7N 127.6E	VQ-R-10---	500M	----	60	----	----	--/22	CIRC		35	--	STORM WELL DEVEL-	16.7N 126.8E
28	141530Z	17.9N 127.0E	VQ-R-10---	500M	----	65	----	----	--/23	CIRC		40	--	WC OPEN SE QUAD	19.0N 127.0E
29	142210Z	18.0N 126.7E	54-P- 5---	700MB	85	----	960	2755	11/06	CIRC		35	--	CLSD WC	
30	150400Z	18.1N 126.1E	54-P- 5---	700MB	75	65	964	2783	16/08	CIRC		35	--	CLSD WC	
31	150536Z	18.0N 126.0E	SATELIT---	STG X	DIA	3	CAT 3.0								
32	151006Z	18.1N 125.7E	VQ-R- 8---	310M	----	45	----	----	--/--	CIRC		21	--	CLSD WC	19.2N 125.2E
33	151602Z	18.7N 125.7E	VQ-P- 5---	700MB	----	80	964	2786	17/10	CIRC		30	11	CLSD WC	
34	152200Z	18.9N 125.8E	54-P- 5---	700MB	75	60	968	2812	17/11	CIRC		35	--	CLSD WC	
35	160130Z	19.4N 125.9E	54-P- 8---	700MB	85	----	972	2835	16/12	CIRC		35	--	CLSD WC	
36	160400Z	19.8N 126.1E	54-P- 4---	700MB	75	50	971	2835	16/11	CIRC		35	--	CLSD WC	
37	160634Z	20.0N 126.5E	SATELIT---	STG X	DIA	3	CAT 3.0								
38	160950Z	20.4N 126.3E	VQ-P- 5---	320M	80	75	974	----	25/22	CIRC		45	--	WC OPEN SW QUAD	
39	161242Z	20.8N 126.4E	VQ-P- 7---	340M	70	70	979	----	27/24	CIRC		60	--	WC OPEN SW SEMIC	
40	161534Z	21.3N 126.0E	VQ-P-10---	700MB	----	55	980	2940	17/09	CIRC		60	5	WC OPEN SW SEMIC	
														WEAK FB ACTIVITY	
41	162200Z	21.9N 127.0E	54-P- 2---	700MB	65	55	985	2963	16/13	----	-----	--	--	NO WC	

TYPHOON VERA
EYE FIXES FOR CYCLONE NO. 3
08 APR - 18 APR 71

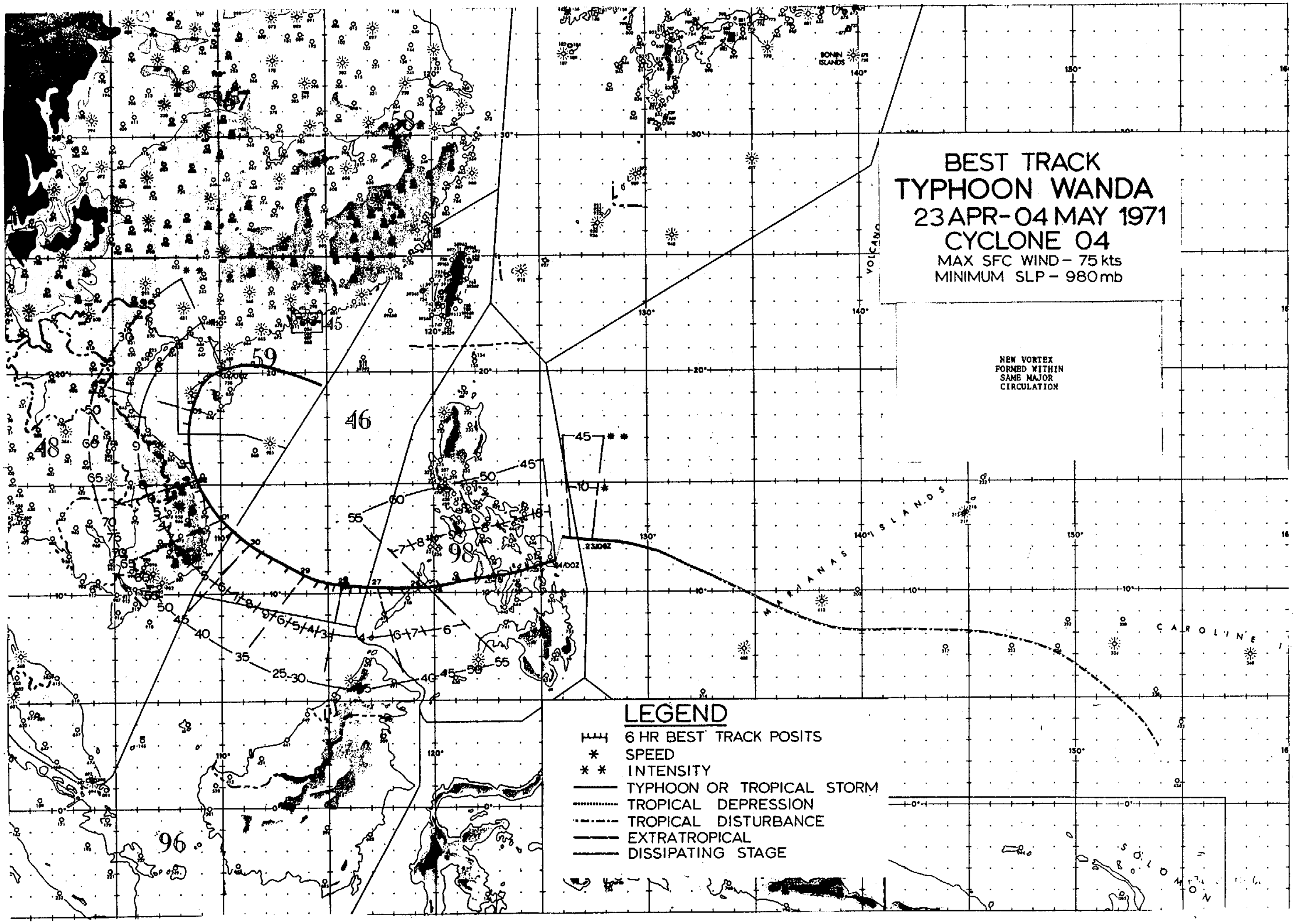
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
42	170400Z	22.8N 127.7E	54-P- 5---	700MB	75	70	984	2944	16/14	----	-----	--	--	NO WC-RDR POOR	
43	170537Z	23.0N 127.5E	SATELIT---	STG C										APPEARS WEAKER	
44	171011Z	24.0N 128.6E	VQ-P- 8---	400M	----	60	985	----	24/19	----	-----	--	--	NO WC - MDT FRS	
45	171605Z	25.0N 130.5E	VQ-P- 5---	700MB	----	35	994	2950	10/09	----	-----	--	--	POOR RDR PRES	
46	172200Z	25.7N 131.9E	54-P-10---	700MB	45	----	998	3008	10/09	----	-----	--	--	NO RDR PRES	
47	180445Z	26.0N 132.5E	SATELIT---	STG C											
48	180515Z	26.0N 132.6E	54-P- 2---	700MB	30	35	997	3027	14/14	----	-----	--	--	FLAT PRESS GRAD NO RDR PRES	

TYPHOON VERA

0600Z 8 APR TO 0600Z 18 APR

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
080600Z	9.2N 140.5E	25	9.0N 140.0E	30	32	5	9.5N 134.2E	50	320	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
081200Z	9.5N 140.3E	25	9.5N 140.0E	30	18	5	9.9N 136.1E	45	198	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
081800Z	9.7N 140.1E	25	9.5N 140.0E	30	13	5	9.8N 137.7E	40	128	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
090000Z	10.1N 139.8E	25	10.0N 139.3E	30	30	5	10.8N 135.3E	40	182	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
090600Z	10.7N 139.5E	30	11.1N 138.5E	30	63	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091200Z	11.4N 139.1E	30	11.4N 138.5E	30	35	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091800Z	11.7N 138.7E	30	12.0N 138.4E	30	25	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100000Z	11.9N 138.2E	30	12.3N 138.4E	25	27	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
120600Z	13.4N 133.3E	40	13.0N 133.6E	40	30	0	12.8N 130.3E	50	134	0	13.4N 127.1E	50	239	-25	--.- ---.-	--	--	--
121200Z	13.6N 132.7E	40	13.6N 132.9E	45	12	5	15.3N 130.5E	50	19	-10	17.0N 129.0E	50	98	-30	18.8N 128.1E	30	146	-5[illegible]
121800Z	14.0N 132.2E	45	14.1N 132.2E	45	6	0	15.8N 130.2E	50	52	-15	17.6N 129.0E	50	116	-35	--.- ---.-	--	--	--
130000Z	14.4N 131.6E	45	14.5N 131.7E	50	8	5	16.6N 129.8E	60	69	-10	18.6N 128.4E	60	114	-30	20.5N 128.0E	40	141	-40
130600Z	14.9N 131.1E	50	14.8N 131.0E	55	8	5	16.4N 129.0E	60	78	-15	18.3N 127.5E	60	87	-30	--.- ---.-	--	--	--
131200Z	15.6N 130.4E	60	15.5N 130.4E	60	6	0	17.4N 128.3E	70	51	-10	19.3N 126.6E	60	87	-25	21.3N 125.1E	40	81	-30
131800Z	16.2N 129.4E	65	16.4N 129.5E	60	13	-5	18.8N 127.0E	60	48	-25	21.0N 125.3E	40	144	-45	--.- ---.-	--	--	--
140000Z	16.6N 128.6E	70	16.9N 128.7E	65	19	-5	19.5N 126.3E	50	90	-40	22.1N 124.7E	40	186	-40	24.9N 123.4E	25	267	-40
140600Z	17.3N 128.0E	75	17.5N 128.0E	65	12	-10	20.2N 125.9E	50	132	-40	22.9N 124.3E	35	218	-40	--.- ---.-	--	--	--
141200Z	17.8N 127.5E	80	18.0N 127.5E	70	12	-10	20.6N 125.6E	60	143	-25	23.4N 124.1E	45	205	-25	26.2N 123.0E	25	356	-2[illegible]
141800Z	18.0N 127.0E	85	18.4N 127.0E	70	24	-15	20.7N 125.4E	60	126	-25	22.9N 124.3E	45	160	-20	--.- ---.-	--	--	--
150000Z	18.0N 126.5E	90	18.9N 126.6E	85	54	-5	21.5N 125.0E	75	146	-5	23.8N 124.3E	60	189	-5	28.4N 125.6E	35	381	0
150600Z	18.0N 126.0E	90	18.2N 125.9E	85	13	-5	19.9N 123.9E	90	130	15	22.8N 122.8E	80	281	20	--.- ---.-	--	--	--
151200Z	18.2N 125.6E	85	18.2N 125.6E	85	0	0	20.0N 123.7E	90	157	20	23.1N 122.8E	80	356	30	--.- ---.-	--	--	--
151800Z	18.6N 125.5E	85	18.8N 125.4E	85	13	0	20.7N 123.7E	85	172	20	23.9N 123.3E	75	415	35	--.- ---.-	--	--	--
160000Z	19.2N 125.9E	80	19.5N 125.7E	85	21	5	21.0N 125.2E	80	129	15	23.8N 125.3E	70	386	35	--.- ---.-	--	--	--
160600Z	19.7N 126.2E	75	20.0N 126.0E	80	21	5	23.1N 126.9E	70	55	10	26.9N 129.7E	50	183	15	--.- ---.-	--	--	--
161200Z	20.7N 126.4E	70	20.6N 126.4E	80	6	10	24.2N 127.3E	65	104	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161800Z	21.4N 126.7E	65	21.7N 126.6E	75	19	10	25.4N 128.1E	60	146	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170000Z	22.1N 127.2E	65	22.2N 127.0E	70	13	5	25.9N 129.0E	50	167	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170600Z	23.2N 127.9E	60	23.1N 127.8E	70	8	10	26.6N 131.8E	50	71	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
171200Z	24.2N 129.2E	50	24.4N 128.9E	65	20	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
171800Z	25.2N 130.8E	40	25.5N 130.9E	55	19	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
180000Z	25.7N 132.1E	35	25.9N 132.5E	40	25	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
180600Z	26.1N 133.0E	35	26.1N 133.0E	35	0	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	15NM	106NM	204NM	229NM	19NM	122NM	204NM	229NM
AVERAGE RIGHT ANGLE ERROR	12NM	61NM	133NM	189NM	15NM	81NM	133NM	189NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	17KTS	29KTS	32KTS	5KTS	17KTS	29KTS	32KTS
AVERAGE BIAS OF WIND ERROR	2KTS	-4KTS	-13KTS	-32KTS	2KTS	-1KTS	-13KTS	-32KTS
NUMBER OF FORECASTS	25	21	17	6	33	25	17	6


BEST TRACK
TYPHOON WANDA
23 APR-04 MAY 1971
CYCLONE 04
MAX SFC WIND - 75 kts
MINIMUM SLP - 980 mb
NEW VORTEX FORMED WITHIN SAME MAJOR CIRCULATION
BONIN ISLANDS
VOLCANO
MARIANAS ISLANDS
CAROLINE
SOLOMON
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE

WANDA

Wanda, followed by Amy and Babe, heralded the greatest outbreak of tropical-storm activity in any spring on record. Her genesis can be traced back as far as the central Carolines on April 15th. Drifting west-northwest for a period of over a week, the diffuse system began to take character and strengthen into a tropical storm on the 23rd, 150 n mi east of Samar in the central Philippines. A new vortex formed south of the original one and Wanda tracked across the island near the Leyte Gulf with winds of 50 to 60 kt. The storm passed over the Visayas and into the Sulu Sea, crossing Palawan Island the afternoon and evening of the 26th.

A peak gust of 84 kt was observed at Tacloban City, however, this may have been due to channeled winds between the islands of Samar and Leyte. The typhoon left 56 dead in the Philippines with 39 reported missing. Damage to public and private property was estimated near 700,000 dollars (U.S.).

Upon entering the South China Sea, Wanda slowed in forward speed to 3-4 kt for a 24-hour period and weakened to a depression (Figure 5-3). At this point the chances for her to regain strength were considered slight. Surprisingly, during the evening of the 29th, Wanda regained her tropical storm status. In the meantime the storm had swung to a northwesterly course as it rounded the southeastern periphery of the subtropical ridge which was extending across the northern South China Sea.

Continuing to intensify, typhoon force was attained less than 60 n mi off the Vietnam coast southeast of Qui Nhon, as Wanda began to recurve in response to a trough in the westerlies coming off the Tibetan Plateau. Reaching a peak intensity of 75 kt, the typhoon paralleled the coastline (Figure 5-4) for 30 hours on May 1st and 2nd, the eye barely touching ashore near Quang Ngai.

Wanda weakened to tropical-storm force upon leaving the Vietnamese coast line and struck Hainan Island on the 3rd with winds of 45 kt. Coming under the influence of the westerlies, the system quickly assumed extratropical characteristics. The remains of the system drifted on an easterly course and dissipated some 36 hours later in the northern South China Sea.

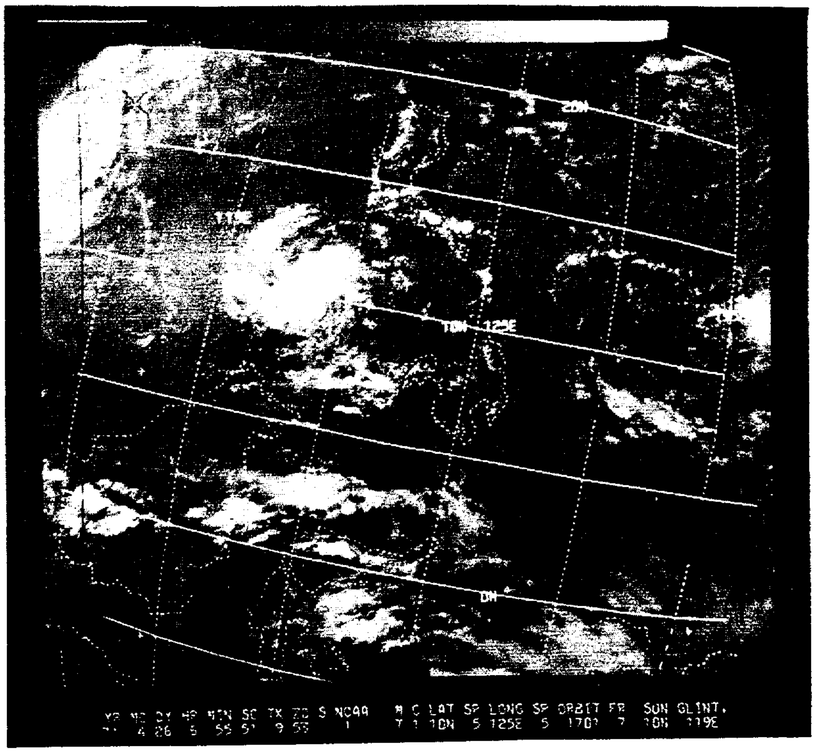


FIGURE 5-3. WANDA AS A MINIMAL TROPICAL STORM WEST OF THE CENTRAL PHILIPPINES ON 26 APRIL.

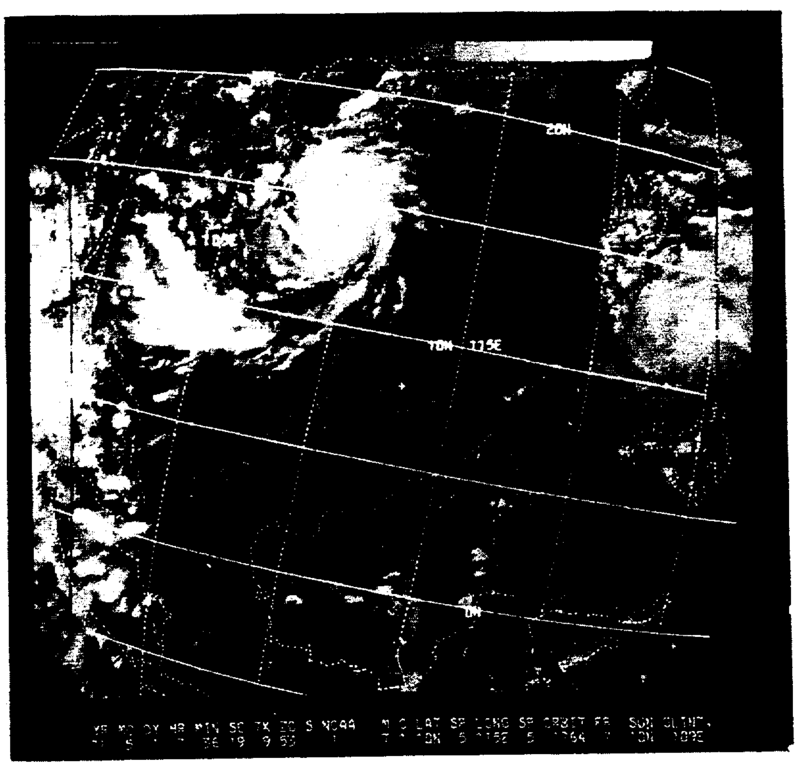


FIGURE 5-4. NOAA-1 VIEW OF TYPHOON WANDA ALONG THE SOUTH VIETNAM COAST ON 1 MAY. DISTURBANCE OVER THE PHILIPPINES IS THE FORMATIVE STAGES OF TROPICAL STORM BABE.

Typhoon Wanda was the first significant storm in more than 20 years to affect the coast of Vietnam during April or May. At Chu Lai maximum winds of 35 kt with gusts to 63 kt were reported. Landing Zone "English" sustained 50-kt winds and gusts were estimated near 70 kt. Maximum rainfall amounts of 7.5 inches and 8.25 inches were reported at Landing Zone "English" and Duc Pho respectively. Over 23 people were killed in the Quang Ngai province and over 10,000 homes and buildings were partly or completely destroyed.

TYPHOON WANDA
EYE FIXES FOR CYCLONE NO. 4
23 APR - 04 MAY 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	230303Z	12.2N 127.9E	54-P- 5---	700MB	40	45	991	2993	12/11	----	-----	--	--	WC FRMG NW QUAD	
														700 CNTR 14NM SE	
2	230608Z	12.0N 127.0E	SATELIT---	STG B										FIRST SAT BLTN	
3	231010Z	12.4N 126.6E	VQ--- 3---	-----	----	40	---*	----	--/--	CIRC		10	5	WC OPEN SE QUAD	12.3N 127.0E
4	231410Z	12.4N 126.1E	VQ-P- 3---	700MB	50	----	993	3060	16/10	ELIP	E-W	16X13	5	WC OPEN SE QUAD	
5	231550Z	12.4N 126.0E	VQ-P- 3---	700MB	34	----	993	3060	15/10	CIRC		8	--	WC OPEN SE QUAD	
6	240100Z	11.2N 125.6E	54-P-10---	500MB	45	----	---*	2720	+2/-2	CIRC		12	--	CLOSED WC	
7	240400Z	11.3N 125.3E	54-P- 1---	500MB	50	40	---*	----	--/--	CIRC		6	--	CLOSED WC	
8	240702Z	11.5N 125.0E	SATELIT---	STG C+										INTENSIFYING	
9	241017Z	11.1N 124.5E	VQ-R-10---	-----	----	----	---*	----	--/--	CIRC		12	--	CLOSED WC	11.4N 125.4E
10	241544Z	11.1N 123.8E	VQ-R-10---	-----	----	----	---*	----	--/--	CIRC		19	--	WC OPEN NW QUAD	11.7N 123.7E
														RDR PRES BCMG WKR	
11	242200Z	10.8N 123.2E	54-P- 5---	500MB	50	----	---*	----	-1/-3	CIRC		15	--	WC OPEN SE	
12	250335Z	10.6N 122.2E	54-P- 2---	500MB	85	----	---*	----	-1/-2	ELIP	E-W	20X13	10	CLOSED WC	
13	250756Z	10.5N 122.0E	SATELIT---	STG X	DIA	3	CAT 2.0								
14	251000Z	10.6N 121.4E	VQ-R- 1---	-----	35	----	---*	----	--/10	CIRC		18	10	CLSD WC- RDR PRES	9.8N 121.0E
														GOOD - MOT FB W	
15	251252Z	10.7N 120.9E	VQ-P- 1---	700MB	39	----	991	3078	16/10	ELIP	E-W	18X14	--	CLSD WC	
16	251538Z	10.6N 120.5E	VQ-P- 1---	700MB	50	----	988	3063	17/14	CIRC		20	11	WC OPEN NW QUAD	
17	252200Z	10.2N 120.0E	54-P- 2---	700MB	50	60	989	2999	16/11	CIRC		12	--	WC OPEN NW QUAD	
18	260357Z	10.3N 119.4E	54-P- 1---	500MB	26	50	---*	----	-2/-3	----	-----	--	6	RDR PRES POOR	
19	260655Z	10.0N 119.5E	SATELIT---	STG B										WEAKENING	
20	261000Z	10.3N 118.9E	VQ-R-15---	-----	----	----	---*	----	--/--	----	-----	--	--	STORM DISORG	9.9N 119.0E
21	261535Z	10.6N 118.1E	VQ-P- 5---	420M	----	40	999	----	26/22	----	-----	25X20	--	WC OPEN E	
22	262200Z	10.2N 117.4E	54-P- 5---	700MB	35	----	998	3060	17/15	CIRC		35	--	WC POORLY DEF	
23	270400Z	10.2N 117.1E	54-P- 5---	700MB	26	30	999	3115	13/11	----	-----	--	--	NO WC	
24	270749Z	12.0N 115.0E	SATELIT---	STG B											
25	270935Z	10.2N 116.8E	VQ-P- 5---	700MB	----	----	---*	----	--/--	----	-----	--	--	WIND CNTR 7NM DIA	
26	271555Z	10.2N 116.2E	VQ-P- 5---	700MB	27	----	997	----	14/14	CIRC		14	--	NO WC	
27	272145Z	10.5N 115.9E	54-P- 3---	700MB	----	25	1000	3088	11/09	----	-----	--	--	CNTR DEF BY SC	
28	280653Z	11.5N 115.0E	SATELIT---	STG B											
29	281041Z	10.7N 114.4E	VQ-P- 5---	400M	----	20	1003	----	27/24	----	-----	--	--	THIN FB SPIRALING	
														INTO CNTR	
30	282215Z	10.8N 114.2E	54-P- 5---	400M	35	30	999	----	26/24	----	-----	--	--	RDR PRES POOR	
31	290742Z	12.5N 113.0E	SATELIT---	STG C											
32	291703Z	12.0N 112.1E	VQ-P- 5---	700MB	32	----	999	3109	14/12	----	-----	--	--	WIND EYE 5NM DIA	
33	292215Z	12.1N 111.6E	54-P- 3---	700MB	50	45	1000	3060	12/11	----	-----	--	--	700 CNTR 15NM N	
34	300400Z	12.4N 111.2E	54-P- 3---	700MB	52	50	994	3057	14/11	CIRC		20	10	WC OPEN S SEMIC	
35	300720Z	12.5N 111.0E	VQ-R- 2---	-----	----	----	---*	----	--/--	----	-----	15	--	WELL ORGANIZED	12.1N 111.4E
36	300745Z	12.6N 111.0E	VQ-P- 5---	400M	----	45	993	----	26/23	CIRC		15	--	WC OPEN NW QUAD	
37	300819Z	13.0N 111.1E	SATELIT---	STG X	DIA	3	CAT 2.0								
38	301016Z	12.8N 110.8E	VQ-P- 5---	320M	----	55	993	----	26/26	CIRC		25	--	WC OPEN W	
39	301248Z	12.8N 110.6E	VQ-P- 8---	300M	----	45	994	----	26/23	CIRC		25	--	WELL ORGANIZED	
40	301600Z	13.1N 110.5E	54-P- 1---	700MB	50	----	980	2951	14/11	CIRC		35	--	WC OPEN N-SE	
41	301900Z	13.1N 110.4E	54-P- 1---	700MB	50	----	980	2951	14/09	CIRC		35	--	CLSD WC	
42	302200Z	13.2N 110.3E	54-P- 1---	700MB	50	----	982	2923	14/11	CIRC		32	--	CLSD WC	
43	010123Z	13.9N 109.9E	VQ-P- 5---	400M	----	70	985	----	26/22	CIRC		20	14	CLSD WC	
44	010355Z	13.9N 109.7E	VQ-P- 3---	700MB	43	65	987	2993	18/09	CIRC		28	6	WC OPEN SW QUAD	
45	010642Z	14.0N 109.6E	VQ-P- 2---	700MB	77	----	981	2978	19/11	ELIP	N-S	21X16	10	WC TOPS 20K FT	
46	010741Z	14.0N 109.5E	SATELIT---	STG X	DIA	2	CAT 0.3								

TYPHOON WANDA
EYE FIXES FOR CYCLONE NO. 4
23 APR - 04 MAY 71

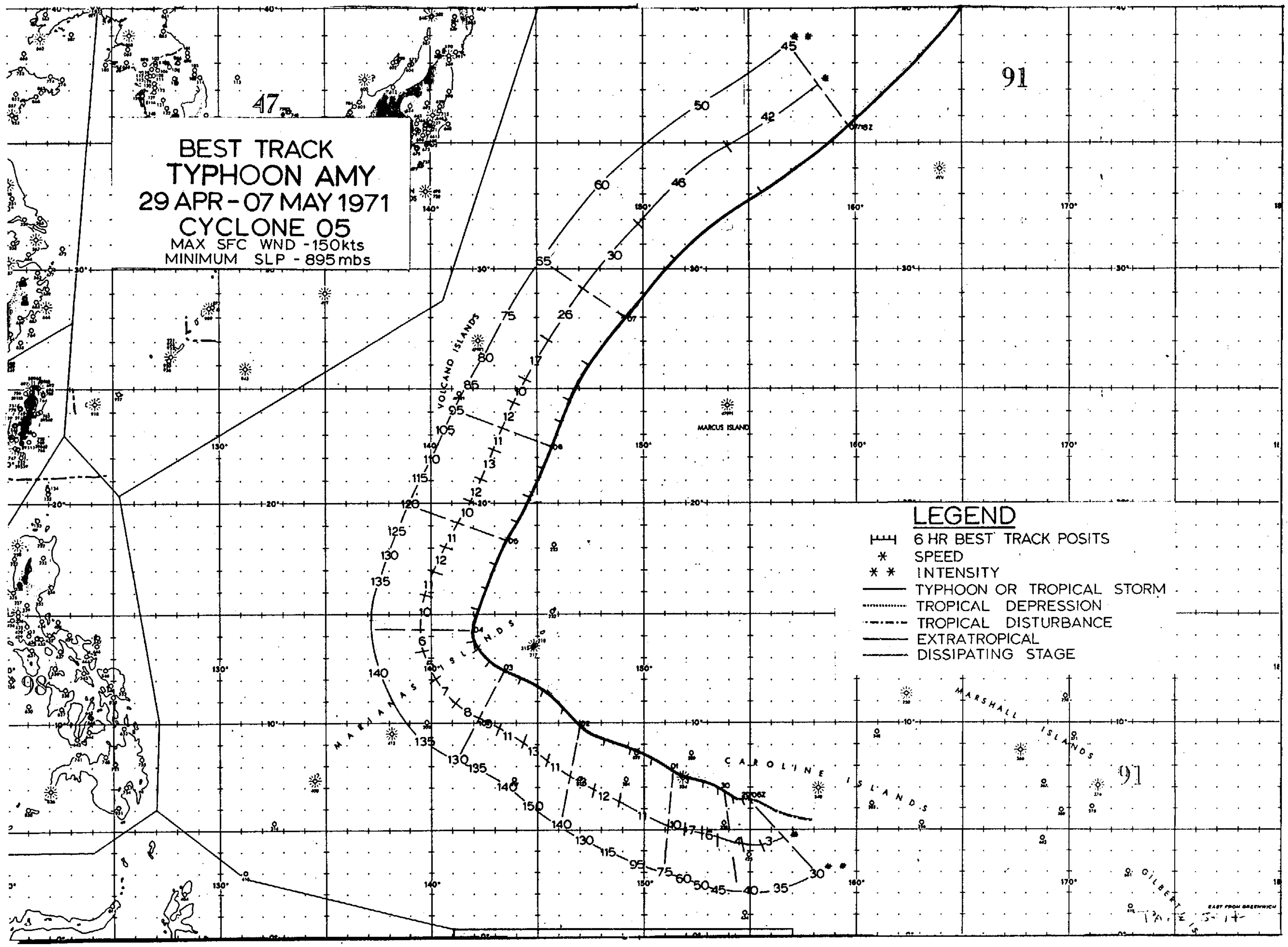
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
47	011000Z	14.4N 109.5E	54-P- 3---	700MB	50	70	980	2914	17/10	CIRC		20	--	CLSD WC	
48	011300Z	14.5N 109.4E	54--------	700MB	52	----	----	----	--/--	----	-----	--	--	FIX BSD ON FL WND	
49	011530Z	14.5N 109.4E	----------	-----	----	----	----	----	--/--	----	-----	--	--	RDR SITE 118NM NW	
50	011855Z	14.8N 109.2E	VQ-R- 8---	-----	----	----	----	----	--/--	ELIP	E-W	30X22	--	CLSD WC - EYE OVR LND - INTENSE FBS	14.9N 109.7E
51	012217Z	15.1N 108.8E	VQ-R- 8---	-----	----	----	----	----	--/--	ELIP	SE-NW	44X32	--	CLSD IRREG WC	14.9N 109.7E
52	020047Z	15.4N 108.9E	VQ-R- 5---	-----	----	----	----	----	--/--	ELIP	NE-SW	27X20	--	CLSD WC	14.7N 109.7E
53	020404Z	15.8N 108.8E	54-P- 1---	700MB	41	65	976	2951	16/12	CIRC		38	--	CLSD WC	
54	020700Z	16.2N 108.8E	54-P- 1---	700MB	52	70	987	2951	16/12	CIRC		30	--	CLSD WC	
55	020835Z	16.0N 109.0E	SATELIT---	STG X	DIA	2. CAT	3.0								
56	021000Z	16.6N 108.9E	54-P- 1---	700MB	50	65	986	2981	16/12	CIRC		40	--	CLSD WC	
57	021329Z	17.3N 108.9E	VQ-R-10---	-----	27	----	----	----	--/--	----	-----	--	--	WC OPEN S SEMIC	16.7N 110.3E
58	021600Z	17.6N 108.6E	VQ-R- 3---	500M	26	----	----	----	--/--	CIRC		32	--	EYE WEAKENING	16.5N 108.9E
59	021920Z	18.0N 108.7E	VQ-R- 4---	800M	29	----	----	----	--/--	ELIP	E-W	39X25	--	EYE RAGGED	16.6N 108.8E

TYPHOON WANDA

0600Z 23 APR TO 0000Z 4 MAY

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
230600Z	12.4N 127.4E	45	12.2N 127.5E	45	13	0	11.5N 124.5E	30	39	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
231200Z	12.5N 126.4E	45	12.3N 126.2E	55	17	10	12.3N 122.0E	30	158	-20	12.3N 117.8E	35	223	-25	12.8N 113.8E	50	318	5
240000Z	11.3N 125.8E	45	11.4N 125.6E	45	13	0	12.5N 124.4E	30	134	-25	12.7N 122.4E	30	205	-25	13.1N 119.4E	35	212	0
240600Z	11.2N 125.1E	45	11.7N 125.0E	40	30	-5	11.8N 122.1E	30	66	-25	12.3N 119.1E	35	120	-15	--.- ---.-	--	--	--
241200Z	11.1N 124.4E	50	11.2N 124.3E	35	8	-15	11.2N 121.2E	30	36	-30	11.5N 118.1E	40	77	-5	12.3N 115.2E	50	145	15
241800Z	10.9N 123.7E	50	11.1N 123.5E	35	17	-15	11.2N 120.5E	35	42	-25	11.6N 117.3E	45	85	5	--.- ---.-	--	--	--
250000Z	10.8N 122.9E	55	10.9N 122.9E	40	6	-15	10.7N 119.8E	40	18	-15	10.9N 116.8E	50	51	15	11.4N 113.8E	60	132	25
250600Z	10.7N 122.1E	55	10.8N 121.8E	45	19	-10	10.7N 118.3E	55	58	5	11.1N 115.1E	65	119	30	--.- ---.-	--	--	--
251200Z	10.6N 121.2E	60	10.6N 121.1E	50	6	-10	10.6N 117.8E	60	50	15	11.1N 114.8E	70	116	35	12.0N 111.9E	70	208	45
251800Z	10.5N 120.4E	60	10.6N 120.2E	55	13	-5	10.7N 116.7E	65	74	25	11.4N 113.5E	70	171	35	--.- ---.-	--	--	--
260000Z	10.4N 119.8E	55	10.3N 119.8E	60	6	5	10.4N 116.5E	65	49	30	11.2N 113.4E	70	149	35	12.7N 110.5E	70	234	35
260600Z	10.3N 119.2E	50	10.3N 119.1E	55	6	5	10.4N 116.3E	65	37	30	11.3N 113.2E	70	143	40	--.- ---.-	--	--	--
261200Z	10.3N 118.6E	45	10.4N 118.5E	50	8	5	10.5N 115.7E	60	54	25	11.4N 113.0E	65	134	40	12.7N 110.5E	65	129	25
261800Z	10.3N 117.9E	40	10.5N 117.8E	50	13	10	11.0N 115.0E	60	82	25	11.9N 112.4E	65	147	30	--.- ---.-	--	--	--
270000Z	10.2N 117.3E	35	10.3N 117.2E	50	8	15	10.5N 114.4E	60	82	25	11.4N 111.8E	65	134	30	12.8N 109.4E	65	120	20
270600Z	10.2N 116.9E	35	10.2N 116.9E	35	0	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
271200Z	10.3N 116.6E	35	10.1N 117.2E	30	37	-5	10.3N 116.8E	30	101	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
271800Z	10.3N 116.2E	35	10.0N 116.0E	30	21	-5	10.3N 114.8E	30	27	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
280000Z	10.4N 115.8E	35	10.4N 115.7E	30	6	-5	11.3N 113.8E	30	32	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
280600Z	10.5N 115.5E	30	10.7N 115.1E	30	26	0	11.9N 113.1E	30	42	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
281200Z	10.5N 115.1E	25	10.7N 114.3E	25	48	0	11.2N 111.8E	25	42	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
281800Z	10.7N 114.6E	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290000Z	10.8N 114.0E	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290600Z	11.2N 113.2E	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	11.6N 112.4E	40	11.7N 112.1E	40	19	0	13.0N 110.0E	40	42	-15	14.7N 107.6E	30	106	-45	--.- ---.-	--	--	--
291800Z	11.9N 111.9E	40	12.0N 111.9E	40	6	0	13.3N 109.9E	40	31	-20	14.7N 107.9E	30	75	-40	--.- ---.-	--	--	--
300000Z	12.3N 111.4E	45	12.2N 111.5E	45	8	0	13.6N 109.4E	50	42	-15	15.0N 107.5E	30	87	-40	--.- ---.-	--	--	--
300600Z	12.6N 111.0E	50	12.5N 111.1E	50	8	0	13.8N 109.3E	55	21	-15	15.2N 107.3E	30	99	-35	--.- ---.-	--	--	--
301200Z	12.8N 110.7E	55	12.8N 110.6E	55	6	0	14.2N 108.9E	50	31	-25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301800Z	13.1N 110.4E	60	13.1N 110.3E	55	6	-5	14.4N 108.7E	40	37	-30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
010000Z	13.4N 110.1E	65	13.4N 110.1E	70	0	5	17.8N 109.6E	70	159	0	22.2N 113.9E	50	369	5	--.- ---.-	--	--	--
010600Z	14.0N 109.6E	70	14.2N 109.6E	70	12	0	17.9N 109.1E	70	115	5	22.0N 112.0E	45	254	10	--.- ---.-	--	--	--
011200Z	14.4N 109.4E	75	14.5N 109.4E	70	6	-5	16.9N 108.9E	70	6	10	20.5N 110.6E	45	103	15	--.- ---.-	--	--	--
011800Z	14.8N 109.2E	70	14.7N 109.3E	70	8	0	16.8N 108.9E	70	61	20	20.1N 110.2E	45	36	20	--.- ---.-	--	--	--
020000Z	15.2N 109.0E	70	15.3N 108.8E	65	13	-5	17.4N 108.2E	65	69	20	20.9N 110.0E	45	42	20	--.- ---.-	--	--	--
020600Z	16.0N 108.8E	65	16.0N 108.6E	65	11	0	19.0N 108.6E	60	18	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
021200Z	16.9N 108.8E	60	16.9N 108.9E	65	6	5	20.0N 110.8E	45	100	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
021800Z	17.8N 108.7E	50	17.9N 108.6E	60	8	10	22.0N 110.2E	30	130	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
030000Z	18.4N 108.8E	45	18.8N 108.7E	55	25	10	22.9N 111.1E	25	171	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
030600Z	18.9N 108.9E	35	19.6N 109.9E	45	70	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
031200Z	19.5N 109.1E	30	19.9N 110.1E	40	61	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
031800Z	19.9N 109.6E	25	19.9N 109.5E	30	6	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
040000Z	20.2N 110.1E	25	20.6N 109.9E	25	26	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	13NM	59NM	145NM	184NM	16NM	67NM	134NM	187NM
AVERAGE RIGHT ANGLE ERROR	8NM	30NM	81NM	70NM	8NM	36NM	68NM	62NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	18KTS	25KTS	18KTS	5KTS	17KTS	26KTS	21KTS
AVERAGE BIAS OF WIND ERROR	-0KTS	-2KTS	-1KTS	18KTS	0KTS	-1KTS	5KTS	21KTS
NUMBER OF FORECASTS	35	32	19	7	40	36	24	8


BEST TRACK
TYPHOON AMY
29 APR - 07 MAY 1971
CYCLONE 05
MAX SFC WND - 150kts
MINIMUM SLP - 895 mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARIANAS ISLANDS
MARCUS ISLAND
CAROLINE ISLANDS
MARSHALL ISLANDS
GILBERT IS

As Wanda was emerging from the central Philippines, synoptic reports and NOAA-1 satellite pictures began to show the embryo of Amy becoming evident on the 26th in the Truk-Ponape area of the central Carolines. The system remained quasi-stationary for three days and, during the evening of the 29th, attained tropical storm strength. The storm commenced to drift toward the Truk Islands while aircraft reconnaissance during late afternoon of the 30th detected evidence of an eye on their radar screens (Figure 5-5).

By daybreak of the 1st, the eye crossed Moen in the Truk Islands with the weather station reporting 65 kt with peak gusts to 98 kt and a minimum pressure of 974.8 mb. The storm continued to intensify as it crossed Namonuito Atoll on a west-northwest track completely destroying the weather station on the atoll (Figure 5-6).

To illustrate the gradient which existed at this time, the last report from Namonuito on the 1st at 0700 GMT indicated a sustained wind of 45 kt from the northeast and sea level pressure of 989.7 mb. A reconnaissance aircraft in the eye of Amy at that time, some 30 n mi southeast of the station, measured 958 mb and maximum winds of 115 kt. In other words, a 32 mb difference existed between the two points or approximately 1 mb per mile.

There was 80% damage in the Truk district including the Hall Islands and Namonuito Atoll as well as equal damage to all structures in the Truk Islands with over 2,250 homes demolished and thousands made homeless (Figures 5-7 and 5-8). A total of 4.5 million dollars damage was sustained in the private and public sectors. One death and several injuries were reported. An additional one million dollars was lost in damage to crops, small businesses, boats, equipment, etc. Hardest hit of the Truk district was Namonuito Atoll. Inspection of damage at Namonuito depicted a scene as if the atoll had been struck by fire. Little foilage was left and bark was stripped from the few remaining trees.

On request of the High Commissioner of the Trust Territories, the Truk district was declared a disaster area by President Nixon.

After a 1000 GMT aircraft fix of the storm over Namonuito Atoll on the 1st, a period of 15 hours elapsed without an aircraft penetration of the eye. On the next penetration fix at 0100 GMT on the 2nd, with Amy positioned

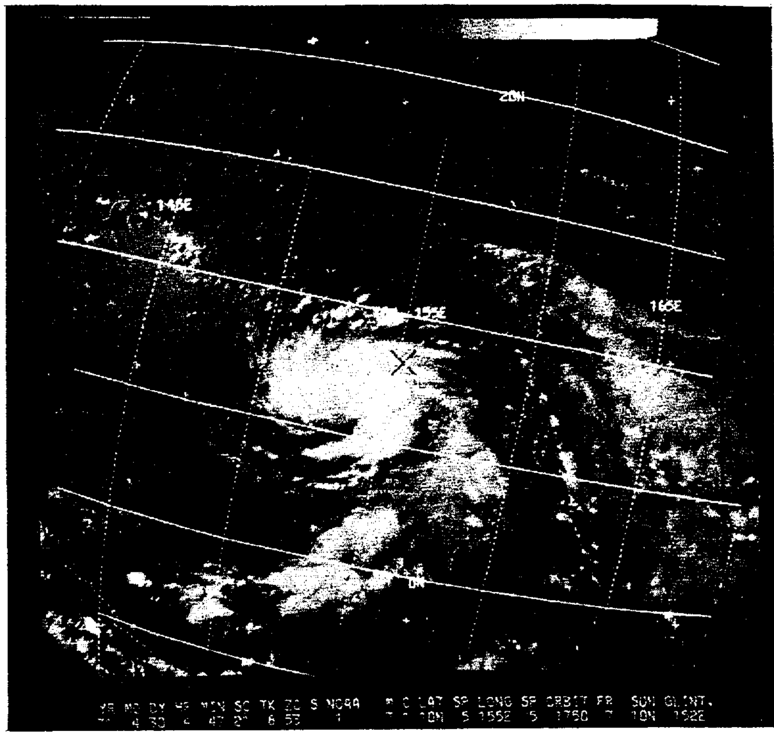


FIGURE 5-5. NOAA-1 PHOTO OF TROPICAL STORM AMY EAST OF TRUK ON 30 APRIL.

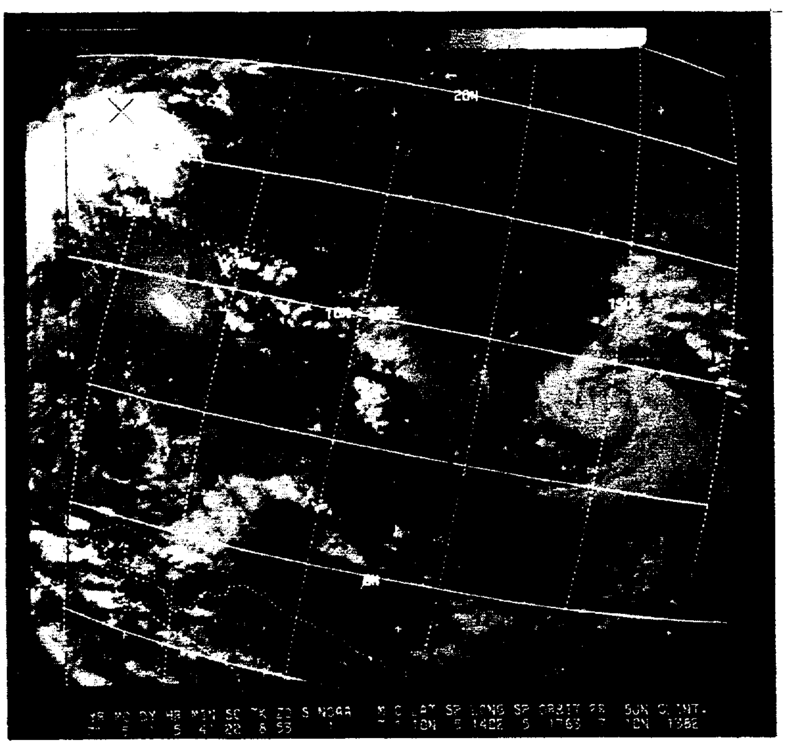


FIGURE 5-6. AMY, GAINING STRENGTH, AFTER PASSAGE OF THE TRUK ISLANDS AS SEEN BY NOAA-1 ON 1 MAY.

250 n mi southeast of Guam, a dropsonde reading indicated Amy had deepened explosively from 950 to 899 mb--a rate of 3.4 mb per hour (Figure 5-9).

During the afternoon Amy reached her peak with a minimum pressure of 895 mb and maximum sustained winds of 150 kt concentrated around a tight circular eye 10 n mi in diameter.

The eye of the typhoon came under surveillance of the radars at Mount Santa Rosa and Andersen AFB about this time. The center tracked south of Guam during the next 12 hours with closest point of approach at 84 n mi on a 208° radial from Apra Harbor.

Amy began to slow in response to the approach of a trough in the westerlies and the weakening of the subtropical ridge line. A slow drift to the northwest occurred about 120 n mi west of Guam on the 3rd. The typhoon then commenced to track northeast at 11 kt west of the Marianas Islands with maximum winds of 120 kt.

Highest winds reported on Guam were 51 kt with a gust to 68 kt (2112 GMT) at Fleet Weather Central (Elev. 600 ft), while Andersen AFB on the northern end of the island sustained winds of 36 kt (1623 GMT) with gusts to 60 kt (2358 GMT). A total rainfall of 15.26 inches was recorded at the National Weather Service Office during the passage of Amy. Minimum sea level pressure observed on the island was at Fleet Weather Central with 998.2 mb.

Damage on Guam amounted to over 900,000 dollars in public and private property damage. On Rota severe crop damage occurred, including destruction of a sea wall as well as damage to bulk storage tanks and feeder pipelines which were washed away at the oil storage yards. In the northern Marianas, minor damage was sustained mostly to the copra and banana trees. The weather station on Pagan reported a maximum wind of 28 kt with gusts to 47 kt.

Amy continued on a northeast course passing the northernmost island of the Marianas, Maug, on the evening of the 5th (Figure 5-10). At a forward speed in excess of 20 kt, she kept a northeast heading through the 6th weakening to minimal typhoon strength. By the 7th Amy decreased to tropical storm intensity and accelerated to greater than 40 kt in forward speed. After crossing the 35th parallel, the storm was overtaken by a cold front early on the 8th.

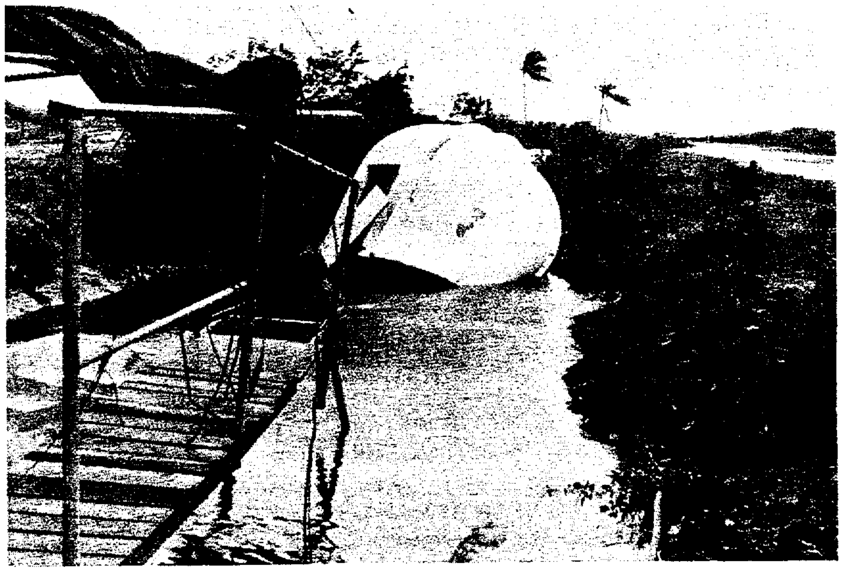


FIGURE 5-7. TRUK'S RAWINSONDE RADOME RESTS IN DRAINAGE DITCH AFTER PASSAGE OF AMY. (THE RADOME, WHICH HAD BEEN REMOVED FROM THE WEATHER STATION'S ROOF AND PLACED ON THE GROUND WHILE AWAITING SERVICING, WAS SEVERELY DAMAGED WHEN IT WAS BLOWN AGAINST A STONE WALL ENROUTE TO ITS FINAL RESTING PLACE IN A DRAINAGE DITCH.)--COURTESY PACIFIC REGION, NATIONAL WEATHER SERVICE.

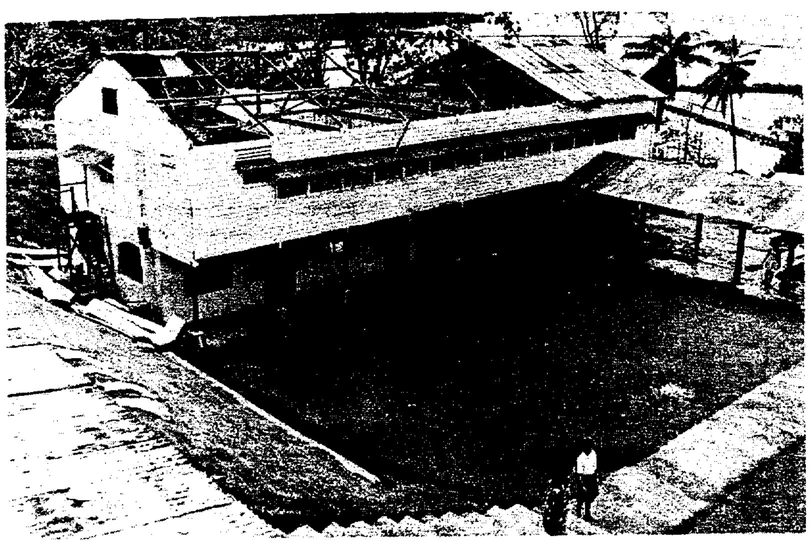


FIGURE 5-8. DAMAGE TO BUILDINGS ON MOEN ISLAND IN THE TRUK GROUP--COURTESY PUBLIC INFORMATION OFFICE, TRUST TERRITORY OF THE PACIFIC ISLANDS.

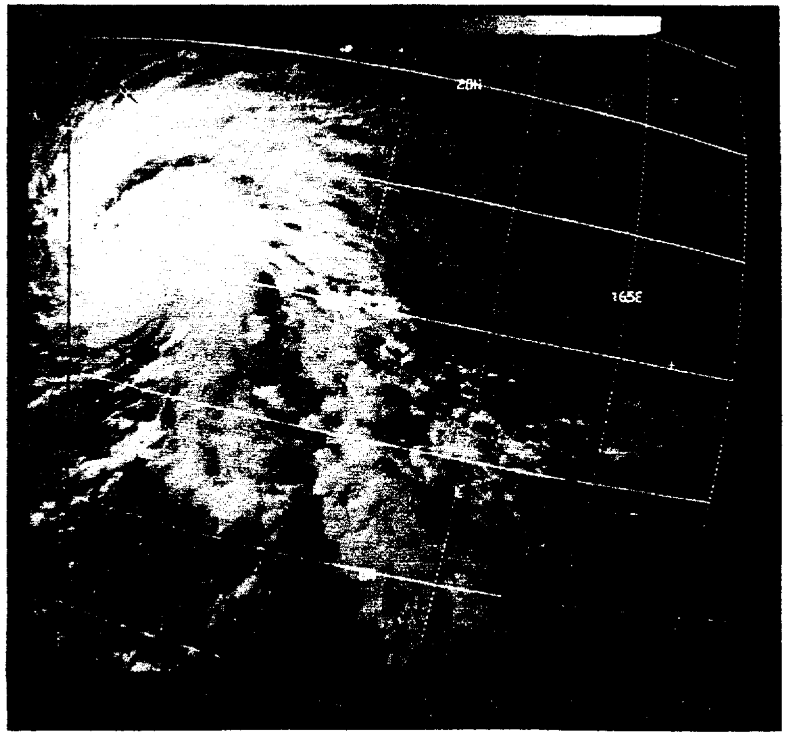


FIGURE 5-9. NOAA-1 VIEW OF SUPER TYPHOON AMY 250 N MI SOUTHEAST OF GUAM ON 2 MAY.

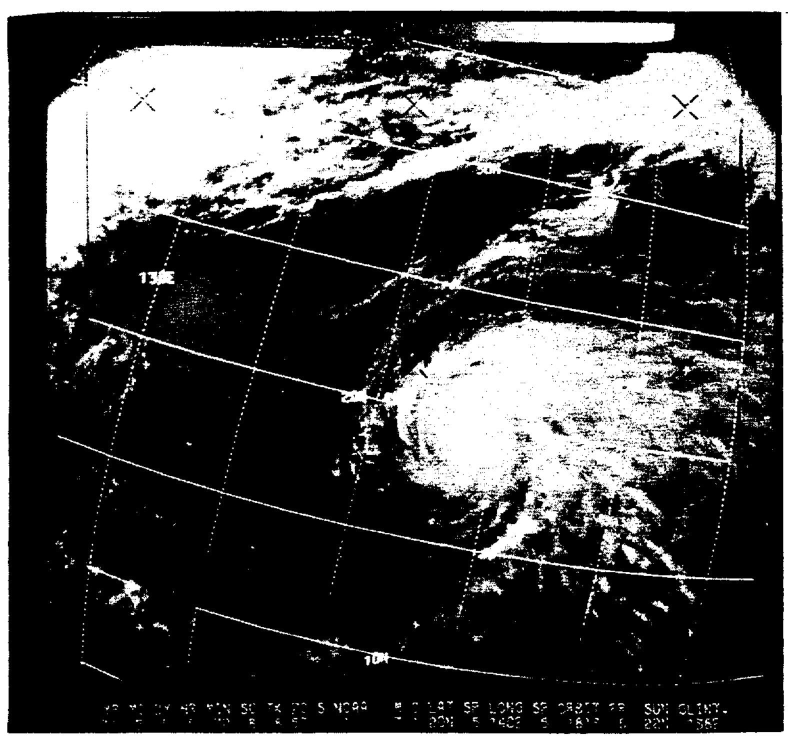


FIGURE 5-10. TYPHOON AMY AS PHOTOGRAPHED BY NOAA-1 ON 5 MAY.

TYPHOON AMY
EYE FIXES FOR CYCLONE NO. 5
29 APR - 07 MAY 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	280454Z	7.5N 153.0E	SATELIT---	STG B										LRG CONV CLD MASS	
2	290130Z	6.5N 155.2E	VQ-P------	-----	----	25	1005	----	--/--	----	-----	--	--	INVESTIGATE FIX	
3	290357Z	6.0N 155.0E	SATELIT---	STG X	DIA	4	CAT 2.0							MORE INTENSE	
4	291747Z	6.7N 154.4E	VQ-R- 6---	400M	----	----	----	----	--/--	CIRC		13	5	STG FBS ALL QUADS	6.1N 153.7E
5	292147Z	6.4N 153.7E	VQ-P-15---	-----	----	48	996	----	27/25	CIRC		17	5	BRKS IN WC	
6	300400Z	6.7N 153.6E	54-P- 5---	-----	38	35	995	3048	28/25	CIRC		20	--	CLSD WC - STORM WELL DEFINED	
7	300447Z	6.5N 153.5E	SATELIT---	STG C+										LTL WKR THAN YSTY	
8	301000Z	7.1N 153.1E	54-P- 5---	700MB	48	----	988	3050	16/12	CIRC		20	--	CLSD WC	
9	301554Z	7.2N 152.1E	VQ-P- 5---	700MB	45	----	----	----	14/10	ELIP	E-W	20	6	HVY FBS E-SW	
10	302104Z	7.4N 151.7E	VQ-P- 5---	700MB	58	60	982	----	16/09	CIRC		30	--	EYE OVER TRUK IS.	
11	010400Z	8.1N 150.7E	54-P-10---	700MB	100	100	961	2768	15/11	CIRC		20	8	CLSD WC - STORM ORGANIZ RAPIDLY	
12	010541Z	8.0N 150.0E	SATELIT---	STG X	DIA	2	CAT 3.0							SML CIRC EYE VIS	
13	010700Z	8.4N 150.2E	54-P- 8---	700MB	135	130	958	2740	15/10	ELIP	NE-SW	20X18	--	CLSD WC	
14	011000Z	8.5N 149.7E	54-P- 5---	700MB	115	----	950	2661	20/15	ELIP	N-S	15X20	--	CLSD WC-STG FBS	
15	011502Z	9.2N 148.7E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		10	--	CLSD WC	9.9N 148.0E
16	020100Z	9.9N 146.9E	54-P- 2---	700MB	135	130	899	2200	25/07	CIRC		10	5	CLSD WC	
17	020400Z	10.3N 146.5E	54-P- 2---	700MB	----	140	896	2169	29/09	CIRC		8	5	SEV TURB SSW QUAD	
18	020445Z	10.0N 146.5E	SATELIT---	STG X	DIA	4	CAT 4.0							SML CIRC EYE VIS	
19	020600Z	10.7N 146.3E	54-P- 2---	700MB	----	140	895	2170	29/09	CIRC		8	--	CLSD WC-TOPS 35K	
20	020840Z	11.2N 145.9E	LND RDR---							----	-----	--	--		
21	020915Z	11.3N 145.8E	LND RDR---							----	-----	--	--		
22	020945Z	11.4N 145.7E	LND RDR---							----	-----	--	--		
23	021015Z	11.5N 145.7E	LND RDR---							----	-----	--	--		
24	021045Z	11.6N 145.7E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
25	021112Z	11.7N 145.5E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
26	021145Z	11.8N 145.4E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
27	021209Z	11.5N 145.3E	54-P- 1---	700MB	125	----	900	2190	29/11	CIRC		10	--	CLSD WC-CONT LTNG	
28	021215Z	11.9N 145.3E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
29	021245Z	11.7N 145.3E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
30	021325Z	11.7N 145.2E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
31	021402Z	11.8N 145.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
32	021432Z	11.8N 145.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
33	021501Z	11.9N 144.9E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
34	021537Z	11.9N 144.8E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
35	021600Z	11.9N 144.7E	54-P- 1---	700MB	120	----	910	2292	21/09	ELIP	NE-SW	12X10	--	AXIS OF ELLIPSE ROTATING RAPIDLY	
36	021605Z	12.0N 144.8E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
37	021631Z	12.0N 144.6E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
38	021704Z	12.0N 144.5E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
39	021803Z	12.0N 144.4E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
40	021815Z	12.0N 144.3E	54-P- 1---	700MB	125	----	----	2387	22/09	CIRC		8	2	CLSD WC	
41	021900Z	12.0N 144.3E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
42	022000Z	12.1N 144.2E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
43	022100Z	12.2N 144.2E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
44	022150Z	12.2N 144.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
45	022231Z	12.3N 143.8E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
46	022255Z	12.3N 143.8E	54-R- 2---	-----	----	----	----	----	--/--	CIRC		20	--	CLSD WC	12.4N 144.6E
47	022330Z	12.3N 143.7E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E

TYPHOON AMY

EYE FIXES FOR CYCLONE NO. 5

29 APR - 07 MAY 71

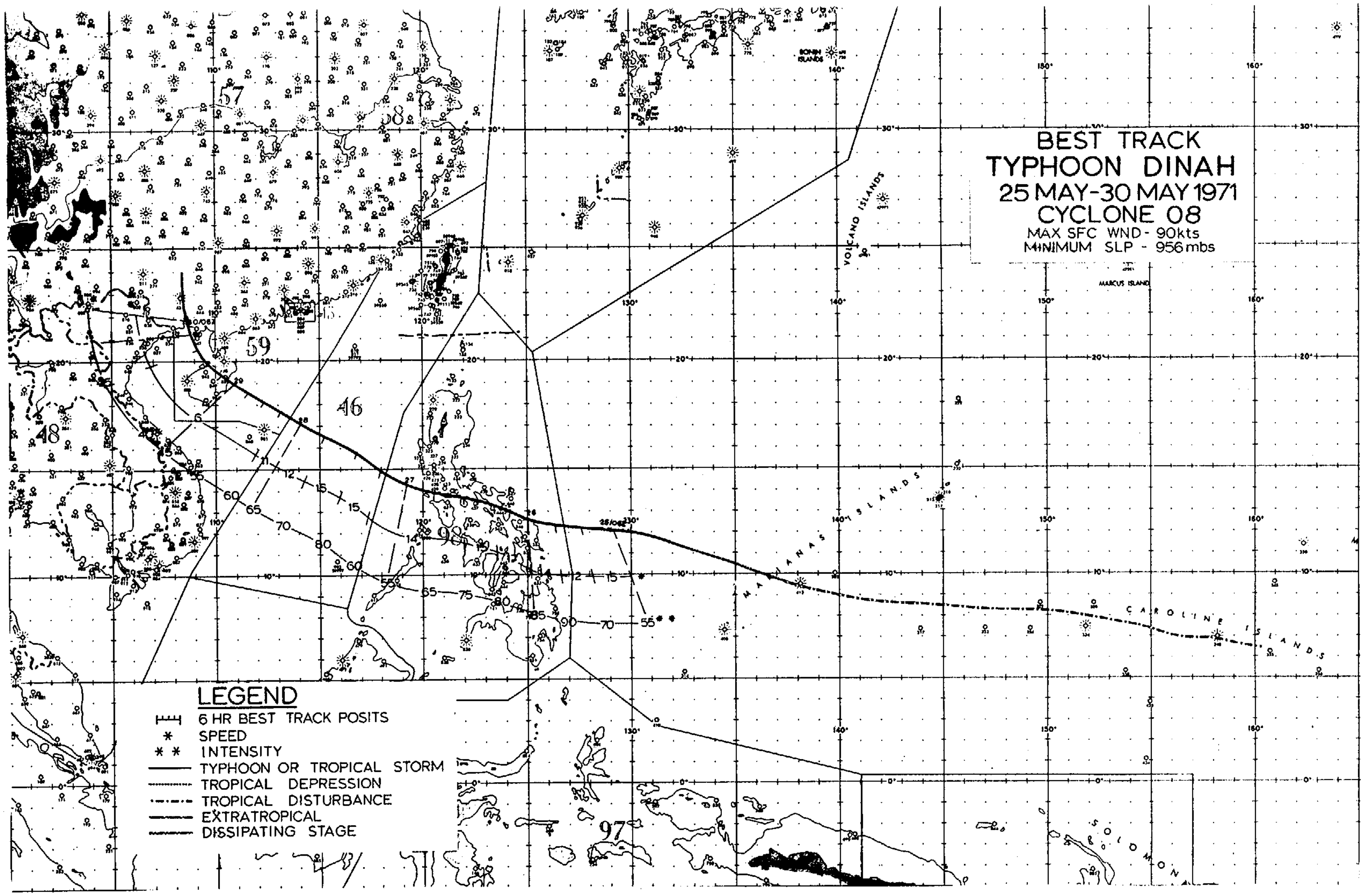
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
48	030002Z	12.4N 143.6E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
49	030200Z	12.6N 143.5E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
50	030400Z	12.6N 143.0E	54-P- 2---	700MB	115	140	915	2387	21/13	CIRC		15	--	SFC CNTR UNDER WC	
51	030400Z	12.7N 143.2E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
52	030430Z	12.7N 143.1E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
53	030500Z	12.8N 143.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
54	030534Z	12.5N 143.0E	SATELIT---	STG X	DIA	4	CAT 3.5							SML CIRC EYE VIS	
55	030544Z	12.8N 143.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
56	030610Z	12.8N 142.8E	VQ-P- 3---	700MB	115	----	906	2365	20/17	CIRC		8	--	CLSD WC	
57	030710Z	12.9N 142.8E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
58	030755Z	13.0N 142.7E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
59	030845Z	13.0N 142.5E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
60	030927Z	13.1N 142.5E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
61	031000Z	13.3N 142.5E	54-P- 2---	700MB	90	----	919	2323	20/12	CIRC		14	--	CLSD WC	
62	031027Z	13.3N 142.4E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
63	031132Z	13.4N 142.4E	54-P- 2---	700MB	105	----	903	2280	23/13	CIRC		14	--	CLSD WC	
64	031255Z	13.4N 142.3E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
65	031415Z	13.5N 142.0E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
66	031555Z	13.7N 141.9E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
67	031600Z	13.6N 142.0E	54-P- 2---	700MB	120	----	901	2213	21/12	CIRC		14	8	CLSD WC-STARS VIS	
68	071118Z	32.5N 155.6E	VQ-P-15---	700MB	65	57	----	2954	14/10	----	-----	--	--	NO CLSD CIRC	
69	031920Z	13.7N 141.9E	LND RDR---							----	-----	--	--	MT SANTA ROSA RDR	13.5N 144.9E
70	032200Z	14.0N 141.9E	VQ-R- 3---	-----	----	----	----	----	--/--	CONC	-	43X13	--	BOTH WC CLSD	
71	040426Z	15.1N 142.1E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		15	--	WC OPEN S	14.6N 141.1E
72	040438Z	15.0N 142.0E	SATELIT---	STG X	DIA	3	CAT 4.0							SML CIRC EYE VIS	
73	040447Z	15.1N 142.1E	VQ-P- 5---	700MB	142	----	907	2451	21/11	CIRC		15	--	WC OPEN S	
74	040915Z	15.7N 142.4E	54-P------	-----	----	----	----	----	--/--	----	-----	--	--	PRELIM FIX	
75	041000Z	15.9N 142.4E	54-P- 1---	700MB	90	----	----	2274	20/09	CIRC		12	5	CLSD WC - TOPS 30	
76	041300Z	16.4N 142.4E	54-P- 1---	700MB	110	----	919	2341	20/13	ELIP	E-W	20X13	10	WC OPEN ESE	
77	041600Z	16.8N 142.9E	54-P- 1---	700MB	130	----	----	2377	18/11	CIRC		20	10	WC OPEN SE	
78	041900Z	17.5N 143.1E	54-P- 2---	700MB	110	----	906	2365	21/14	CIRC		20	--	WC OPEN S QUAD	
79	042140Z	18.0N 143.4E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		15	--	CLSD WC	17.5N 143.8E
80	050053Z	18.4N 143.6E	VQ-P-10---	300M	----	120	934	----	26/22	CIRC		22	--	WC OPEN SE QUAD	
81	050345Z	18.9N 144.1E	VQ-P- 8---	700MB	115	----	940	2652	22/11	CIRC		20	6	WC OPEN S QUAD	
82	050532Z	19.0N 144.0E	SATELIT---	STG X	DIA	3	CAT 2.5								
83	051000Z	19.9N 144.4E	54-P- 3---	700MB	115	----	942	2551	17/10	CIRC		28	7	CLSD WC-THIN CI	
84	051253Z	20.0N 144.1E	---R------	-----	----	----	----	----	--/--	----	-----	30	--	COMM ACFT RDR FIX	
85	051600Z	21.0N 144.9E	54-P- 1---	700MB	100	----	952	2624	15/09	ELIP	SE-NW	40X25	--	CLSD WC-THICK CI	
86	052215Z	21.3N 145.5E	54-P-18---	700MB	90	----	954	2685	15/13	CIRC		10	--	WC POORLY DEF	
87	060100Z	22.6N 145.6E	54-P- 8---	700MB	65	----	----	2829	13/11	----	-----	--	--	SML PART OF WC NNW OF 700 CNTR	
88	060400Z	23.3N 146.0E	54-P-10---	700MB	80	70	957	2722	16/13	----	-----	--	--	NO ORGANIZ ON RDR	
89	060435Z	22.5N 145.0E	SATELIT---	STG X	DIA	3	CAT 3.0							LRG RAGGED EYE	
90	061000Z	24.3N 146.3E	VQ-P- 8---	400M	----	65	960	----	25/22	----	-----	--	--	WEAK 25NM DIA WC	
91	061555Z	25.7N 147.2E	VQ-P- 6---	700MB	----	65	964	2859	17/12	CIRC		25	--	NO WC	
92	062228Z	27.4N 148.9E	54-P- 5---	700MB	75	50	980	2880	14/10	----	-----	--	--	NO RDR PRES-700 CNTR 37 NM NE	
93	070321Z	29.2N 150.4E	54-P- 3---	700MB	72	55	984	2938	13/12	----	-----	--	--	700 CNTR 40NM NE	
94	070525Z	30.0N 152.0E	SATELIT---	STG X	DIA	3	CAT 2.0							700 CLD TOPS 6K	

TYPHOON [illegible]

0600Z 29 APR TO 1200Z 7 MAY

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
290600Z	6.5N 154.9E	30	6.5N 154.8E	25	6	-5	7.2N 153.8E	35	25	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	6.5N 154.7E	35	6.7N 154.3E	25	27	-10	7.1N 152.3E	35	36	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291800Z	6.6N 154.3E	40	6.8N 153.8E	25	32	-15	7.2N 151.8E	40	24	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300000Z	6.7N 153.8E	40	6.5N 153.5E	50	21	10	7.1N 151.3E	65	36	-10	8.3N 149.3E	85	161	-55	9.6N 146.8E	95	256	-3[illegible]
300600Z	6.9N 153.5E	45	6.7N 153.4E	50	13	5	7.3N 151.3E	65	80	-30	8.4N 149.2E	85	219	-65	--.- ---.-	--	--	--
301200Z	7.2N 152.9E	50	7.1N 152.9E	55	6	5	8.5N 151.2E	70	108	-45	9.9N 148.5E	85	211	-55	10.8N 145.5E	95	243	-4[illegible]
301800Z	7.3N 152.2E	60	7.4N 151.9E	55	19	-5	8.8N 149.4E	70	71	-60	9.7N 146.3E	85	181	-50	--.- ---.-	--	--	--
010000Z	7.7N 151.3E	75	7.6N 151.4E	70	8	-5	8.9N 148.8E	80	117	-60	9.9N 145.7E	90	197	-40	10.6N 142.2E	100	222	-4[illegible]
010600Z	8.3N 150.4E	95	8.3N 150.5E	95	6	0	10.0N 147.5E	120	82	-30	11.5N 143.8E	120	97	-15	--.- ---.-	--	--	--
011200Z	8.8N 149.4E	115	8.8N 149.5E	105	6	-10	10.5N 145.8E	125	67	-15	11.8N 142.1E	125	96	-15	12.7N 138.1E	125	334	-5[illegible]
011800Z	9.3N 148.3E	130	9.5N 148.1E	110	17	-20	11.4N 143.7E	125	50	-10	12.5N 139.5E	125	165	-15	--.- ---.-	--	--	--
020000Z	9.9N 147.1E	140	9.9N 147.1E	140	0	0	11.7N 142.6E	150	67	20	12.7N 138.1E	150	235	10	13.3N 134.0E	150	625	3[illegible]
020600Z	10.7N 146.3E	150	10.7N 146.3E	145	0	-5	13.5N 142.9E	150	42	15	14.3N 138.5E	150	227	15	--.- ---.-	--	--	--
021200Z	11.5N 145.3E	140	11.5N 145.5E	150	12	10	13.8N 141.8E	150	38	10	14.4N 137.4E	150	318	20	14.6N 132.9E	100	753	-1[illegible]
021800Z	12.0N 144.3E	135	12.2N 144.3E	140	12	5	13.9N 139.8E	140	128	0	14.4N 134.7E	150	509	25	--.- ---.-	--	--	--
030000Z	12.4N 143.5E	130	12.4N 143.6E	135	6	5	13.8N 139.9E	135	114	-5	14.3N 135.5E	140	520	20	14.5N 130.7E	145	974	5[illegible]
030600Z	12.8N 142.8E	135	12.8N 142.7E	135	6	0	13.8N 138.9E	135	211	0	14.3N 134.5E	140	622	25	--.- ---.-	--	--	--
031200Z	13.4N 142.3E	140	13.4N 142.3E	135	0	-5	15.2N 139.8E	145	172	15	16.1N 136.6E	150	523	40	16.6N 132.9E	150	900	7[illegible]
031800Z	13.8N 142.0E	140	13.8N 141.8E	140	12	0	15.3N 139.5E	150	237	25	16.2N 136.3E	150	594	45	--.- ---.-	--	--	--
040000Z	14.3N 141.8E	140	14.0N 141.9E	145	19	5	15.1N 141.2E	150	237	30	16.3N 139.0E	150	529	55	17.1N 135.3E	150	1013	8[illegible]
040600Z	15.3N 142.2E	135	15.3N 142.1E	140	6	5	19.1N 144.1E	130	6	15	22.4N 148.2E	110	139	25	--.- ---.-	--	--	--
041200Z	16.2N 142.6E	130	16.3N 142.5E	140	8	10	20.1N 145.2E	125	30	15	23.4N 150.1E	100	211	20	25.7N 157.3E	75	449	2[illegible]
041800Z	17.4N 143.0E	125	17.1N 143.1E	135	19	10	20.6N 145.7E	120	61	15	23.5N 150.3E	90	213	15	--.- ---.-	--	--	--
050000Z	18.4N 143.5E	120	18.4N 143.6E	130	6	10	22.3N 147.0E	115	73	20	25.5N 153.0E	80	243	15	--.- ---.-	--	--	--
050600Z	19.2N 144.1E	115	19.2N 144.3E	120	11	5	22.8N 148.0E	100	117	15	25.9N 154.0E	75	299	15	--.- ---.-	--	--	--
051200Z	20.3N 144.7E	110	20.2N 144.6E	115	8	5	24.5N 147.3E	95	45	15	29.3N 152.0E	65	299	15	--.- ---.-	--	--	--
051800Z	21.5N 145.2E	105	21.4N 145.2E	110	6	5	25.6N 148.3E	85	49	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060000Z	22.5N 145.7E	95	22.4N 145.7E	100	6	5	27.2N 148.4E	75	71	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	23.7N 146.1E	85	23.7N 146.4E	95	16	10	29.2N 149.5E	60	126	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	24.7N 146.5E	80	24.7N 146.5E	90	0	10	29.8N 149.4E	50	381	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	26.0N 147.5E	75	26.1N 147.4E	80	8	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	28.0N 149.4E	65	27.8N 149.5E	70	13	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070600Z	30.4N 151.5E	60	30.2N 151.2E	60	20	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
071200Z	33.1N 155.8E	50	33.2N 156.0E	55	12	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	11NM	97NM	296NM	577NM	11NM	97NM	296NM	577NM
AVERAGE RIGHT ANGLE ERROR	7NM	51NM	188NM	339NM	7NM	51NM	188NM	339NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	18KTS	29KTS	40KTS	6KTS	18KTS	29KTS	40KTS
AVERAGE BIAS OF WIND ERROR	2KTS	-3KTS	2KTS	13KTS	2KTS	-3KTS	2KTS	13KTS
NUMBER OF FORECASTS	33	30	23	10	34	30	23	10


BEST TRACK
TYPHOON DINAH
25 MAY-30 MAY 1971
CYCLONE 08
MAX SFC WND - 90kts
MINIMUM SLP - 956mbs
LEGEND
6 HR BEST TRACK POSITS
* SPEED
* * INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARIANAS ISLANDS
CAROLINE ISLANDS
MARCUS ISLAND
BONIN ISLANDS
SOLOMON

DINAH

The incipient stages of Dinah were revealed on the 20th of May when a 700-mb circulation was induced from the mid-Pacific trough in the vicinity of Ponape Island. The system was followed by aircraft reconnaissance and satellite pictures for several days as it crossed through the western Carolines. By the 26th satellite pictures showed the Dinah system to have gained considerable organization. The fact that Dinah was in the process of developing rapidly was verified by the Liberian freighter MV KONKAR RESOLUTE which crossed near the center and reported 60 kt from the north-northwest and a minimum pressure of 988 mb.

The storm continued to intensify to 90 kt before striking the northern coast of Samar on the morning of the 26th. She traversed the central Philippines and exited near Lubang Island (Figure 5-11). A maximum gust of 93 kt was reported at Legaspi City in southern Luzon and a minimum pressure of 979.2 mb was recorded at Tayabas. Dinah left in her wake 13 dead and 44 missing in addition to 6,500 homes destroyed.

Emerging into the South China Sea, Dinah briefly dropped below typhoon strength for a 12-hour period before intensifying up to 80 kt. North of the Paracel Islands she diminished to tropical storm force (Figure 5-12) before striking eastern Hainan with 45 kt. Dinah dissipated rapidly after entering southern China west of the Luichow Peninsula on the 30th.

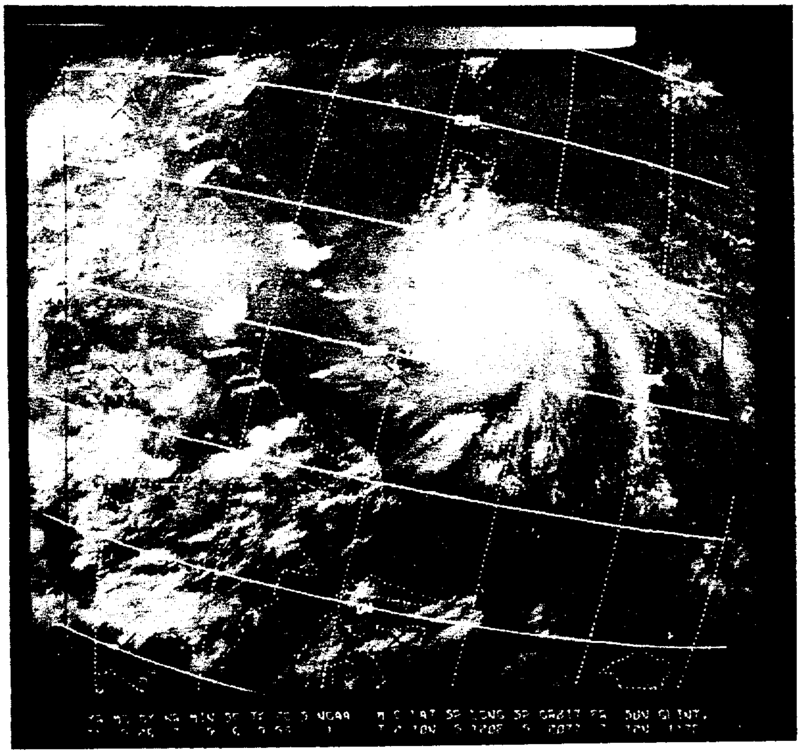


FIGURE 5-11. NOAA-1 VIEW OF TYPHOON DINAH ON 26 MAY OVER SOUTHEASTERN LUZON.

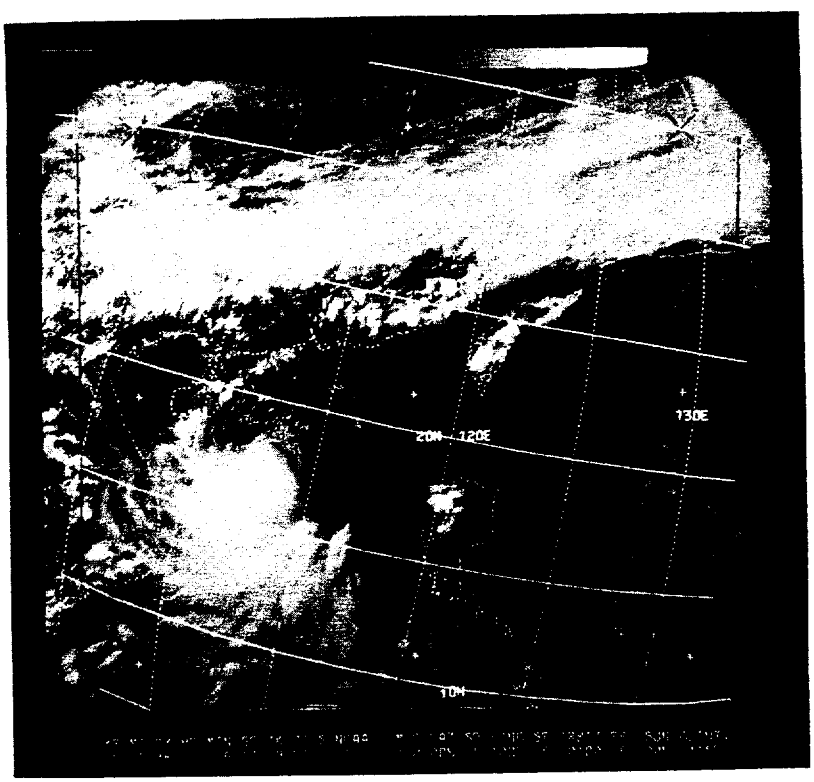


FIGURE 5-12. DINAH, WEAKENED TO TROPICAL STORM STATUS, LOCATED SOUTHEAST OF HAINAN ISLAND AS SEEN BY NOAA-1 ON 28 MAY.

TYPHOON DINAH
EYE FIXES FOR CYCLONE NO. 8
25 MAY - 30 MAY 71

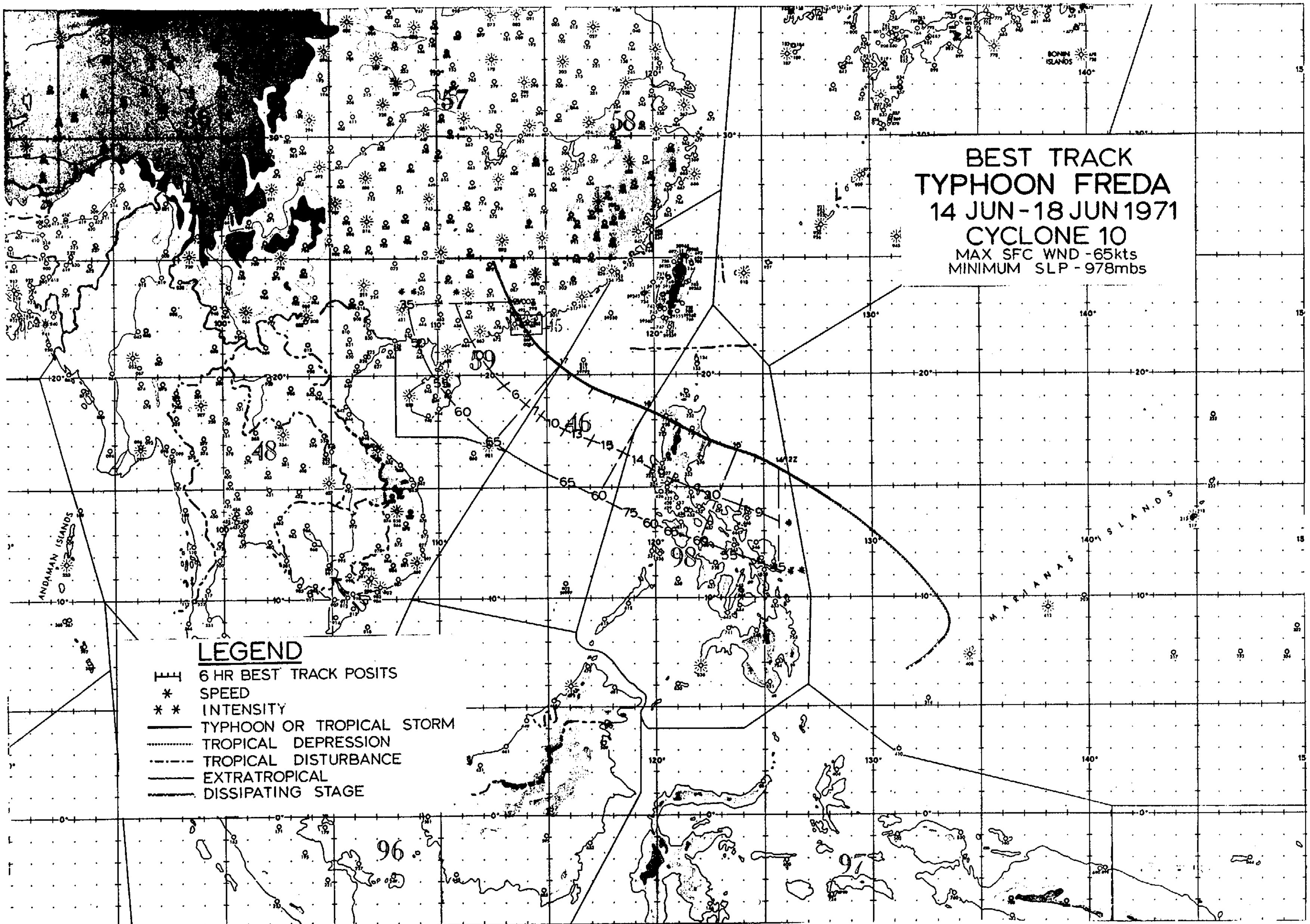
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	210433Z	7.0N 153.0E	SATELIT---	STG B										FIRST SAT BLTN	
2	220528Z	10.0N 147.0E	SATELIT---	STG B										LITTLE CHG	
3	230622Z	9.0N 141.0E	SATELIT---	STG C										MORE INTENSE	
4	240525Z	10.5N 134.5E	SATELIT---	STG C										LITTLE CHG	
5	250615Z	12.0N 128.5E	SATELIT---	STG C+										MORE INTENSE	
6	250912Z	12.3N 128.4E	VQ-R-15---	-----	40	----	----	----	--/--	----	-----	--	--	STRM INTENSIFYING	11.8N 127.2E
7	251630Z	12.2N 126.7E	54-P- 3---	700MB	85	----	972	2841	15/07	CIRC		7	--	CLSD WC	
8	252200Z	12.4N 125.5E	54-P- 5---	700MB	70	90	920	2771	18/13	ELIP	N-S	7X 5	--	CLSD WC	
9	260030Z	12.6N 124.9E	54-P- 5---	700MB	60	80	965	2786	18/13	ELIP	N-S	7X 5	--	CLSD WC	
10	260040Z	12.1N 125.0E	LND RDR---							----	-----	--	--	CATANDUANES RDR	14.0N 124.3E
11	260355Z	13.0N 124.0E	VQ-P- 5---	700MB	85	----	956	2810	15/10	CIRC		8	6	WC OPEN NW	
12	260405Z	12.5N 124.3E	LND RDR---							----	-----	--	--	CATANDUANES RDR	14.0N 124.3E
13	260510Z	13.0N 123.1E	LND RDR---							----	-----	--	--	UNK SITE	
14	260610Z	13.1N 123.5E	LND RDR---							----	-----	--	--	UNK SITE	
15	260700Z	13.2N 123.4E	LND RDR---							----	-----	--	--	UNK SITE	
16	260709Z	12.5N 123.5E	SATELIT---	STG X	DIA	4	CAT 3.5							INTENSIFYING	
17	260711Z	13.3N 123.2E	VQ-R- 5---	-----	----	----	----	----	--/--	CIRC		8	--	CLSD WC	13.2N 124.0E
18	260800Z	13.1N 123.0E	LND RDR---							----	-----	--	--	UNK SITE	
19	260910Z	13.3N 123.0E	LND RDR---							----	-----	--	--	UNK SITE	
20	260932Z	13.4N 122.6E	VQ-P- 5---	700MB	75	----	967	2804	14/09	CIRC		8	3	WC OPEN N	
21	261300Z	13.6N 121.9E	LND RDR---							----	-----	--	--	ADCC RDR	
22	261400Z	13.7N 121.7E	LND RDR---							----	-----	--	--	ADCC RDR	
23	261600Z	14.0N 120.8E	LND RDR---							----	-----	--	--	ADCC RDR	
24	261720Z	14.2N 120.2E	LND RDR---							----	-----	--	--	ADCC RDR	
25	261728Z	13.7N 120.7E	VQ-R-10---	-----	----	----	----	----	--/--	----	-----	--	--	WK WC SE QUAD	13.7N 119.9E
26	261855Z	13.8N 120.5E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		10	3	WC WK-OPEN SW	13.6N 120.2E
27	262010Z	13.8N 120.2E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		10	--	WC REFORMING	13.5N 119.9E
28	262145Z	14.0N 119.7E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		8	--	WC OPEN S QUAD	14.4N 119.1E
29	270115Z	14.3N 119.0E	54-P- 3---	700MB	50	55	976	3008	16/12	CIRC		30	--	STG ELSW - STG FB WC POORLY DEFINED - OPEN W QUAD	
30	270400Z	14.6N 118.3E	54-P- 3---	700MB	50	60	994	2999	16/13	CIRC		30	--	SAME AS 0115Z RMK	
31	270700Z	15.0N 117.6E	54-P- 5---	700MB	65	60	994	2975	15/12	CIRC		25	--	CLSD WC-STRONGER	
32	270803Z	15.0N 117.0E	SATELIT---	STG C											
33	271000Z	15.5N 117.1E	54-P- 2---	700MB	75	85	978	2874	19/17	ELIP	NE-SW	15X10	--	CLSD WC-MDT FBS	
34	271530Z	16.2N 115.8E	54-P- 5---	700MB	75	----	----	2951	19/14	ELIP	NE-SW	15X10	--	WC OPEN W QUAD	
35	280355Z	17.5N 113.4E	VQ-P-10---	700MB	----	75	985	3045	28/24	CIRC		30	--	TEMPS AT 950MB	
36	280706Z	17.5N 113.0E	SATELIT---	STG C											
37	281015Z	17.8N 112.7E	54-P- 5---	700MB	40	65	995	3027	18/13	----	-----	--	--	WC S QUAD	
38	281300Z	18.1N 112.3E	54-P-20---	700MB	35	----	997	3045	16/14	----	-----	--	--	MSLP DOUBTFUL	
39	281600Z	18.2N 111.6E	54-R-15-10	-----	----	----	----	----	--/--	----	-----	--	--	POOR RDR PRES	18.1N 112.0E
40	290800Z	18.0N 109.0E	SATELIT---	STG C											

TYPHOON DINAH

06002 25 MAY TO 06002 30 MAY

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
250600Z	12.1N 129.2E	55	12.1N 129.0E	60	12	5	13.5N 124.1E	100	39	20	14.6N 120.1E	60	128	0	--.- ---.-	--	--	--
251200Z	12.1N 127.6E	70	12.5N 127.8E	65	27	-5	13.8N 122.8E	85	48	10	15.1N 119.0E	65	139	-15	17.1N 115.5E	65	186	10
251800Z	12.7N 126.4E	90	12.2N 126.5E	80	6	-10	13.1N 122.0E	65	91	0	15.1N 118.4E	60	202	-10	--.- ---.-	--	--	--
260000Z	12.5N 125.2E	85	12.4N 125.0E	80	13	-5	13.5N 120.1E	60	67	5	15.4N 116.4E	65	170	0	17.4N 113.4E	65	168	20
260600Z	13.2N 123.5E	80	13.2N 123.5E	80	0	0	15.2N 118.6E	65	47	5	17.5N 115.4E	65	131	5	--.- ---.-	--	--	--
261200Z	13.6N 122.0E	75	13.6N 122.2E	80	12	5	15.8N 117.5E	70	46	-10	18.5N 114.4E	70	116	15	21.5N 112.5E	60	188	25
261800Z	13.8N 120.6E	65	13.8N 120.6E	70	0	5	16.5N 115.6E	75	23	5	20.0N 112.9E	65	116	15	--.- ---.-	--	--	--
270000Z	14.2N 119.2E	55	14.2N 119.1E	70	6	15	16.7N 114.2E	80	30	15	19.9N 111.7E	70	75	25	23.4N 110.8E	25	172	-10
270600Z	14.8N 117.9E	60	14.7N 117.8E	70	8	10	17.6N 113.3E	75	13	15	21.1N 111.4E	60	119	20	--.- ---.-	--	--	--
271200Z	15.8N 116.7E	80	15.7N 116.6E	80	8	0	18.9N 112.4E	80	48	25	22.6N 110.9E	45	177	10	--.- ---.-	--	--	--
271800Z	16.5N 115.2E	70	16.4N 115.3E	80	8	10	19.9N 111.7E	70	84	20	23.7N 115.6E	45	407	10	--.- ---.-	--	--	--
280000Z	17.2N 114.1E	65	17.2N 114.1E	80	0	15	21.1N 111.7E	65	139	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
280600Z	17.7N 113.1E	60	17.8N 113.1E	75	6	15	21.7N 111.2E	55	146	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
281200Z	18.1N 112.4E	55	17.9N 112.4E	65	12	10	20.4N 109.9E	45	34	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
281800Z	18.5N 111.6E	50	18.5N 111.5E	60	6	10	21.4N 109.4E	40	56	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290000Z	18.9N 110.9E	45	19.1N 110.8E	55	13	10	22.4N 109.2E	30	75	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290600Z	19.4N 110.3E	40	19.5N 109.3E	50	57	10	22.9N 107.3E	25	89	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	19.9N 109.6E	35	19.4N 109.2E	50	37	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291800Z	20.5N 109.1E	35	19.6N 108.7E	45	58	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300000Z	21.2N 108.8E	35	19.8N 108.3E	35	88	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300600Z	21.9N 108.5E	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	19NM	63NM	162NM	178NM	19NM	63NM	162NM	178NM
AVERAGE RIGHT ANGLE ERROR	15NM	47NM	100NM	95NM	15NM	47NM	100NM	95NM
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	11KTS	11KTS	16KTS	8KTS	11KTS	11KTS	16KTS
AVERAGE BIAS OF WIND ERROR	6KTS	9KTS	7KTS	11KTS	6KTS	9KTS	7KTS	11KTS
NUMBER OF FORECASTS	20	17	11	4	20	17	11	4



BEST TRACK
TYPHOON FREDA
14 JUN-18 JUN 1971
CYCLONE 10
MAX SFC WND - 65kts
MINIMUM SLP - 978mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
ANDAMAN ISLANDS
MARIANAS ISLANDS
BONIN ISLANDS

Changes in the large-scale circulation over the western Pacific during June caused a readjustment of the subtropical ridge resulting in a strong high cell positioned over the Ryukyu Islands. This synoptic situation largely controlled the formation and movement of all storms from mid-June to mid-July.

Freda was the first in a succession of six storms to cross the Philippine archipelago in a period of less than four weeks. The first signs of the pre-storm system appeared west of the Palau Islands on the 12th. Aircraft reconnaissance located the system two days later as a weak tropical storm which had drifted to a position 300 miles east of central Luzon.

Heading on a west-northwest track (Figure 5-13), Freda intensified to 65 kt just before she struck near Palanan Point on northeastern Luzon on the afternoon of the 15th. Gusts of 80 kt were reported at Vigan on the western coast when the center was emerging back out to sea, while 8.15 inches of rain fell at Baguio. Damage was considerable over northern Luzon but no estimates are available.

Moving into the South China Sea (Figure 5-14), the storm remained near minimal typhoon strength and began to bend toward the northwest. Freda's center passed 50 n mi south of Pratas Island and struck the mainland between Macau and Hong Kong with maximum sustained winds of 50-55 kt. Wind gusts of 70 kt were experienced at Tate's Cairn and up to 103 kt at the Royal Observatory which also registered a minimum pressure of 984.3 mb.

A total of seven deaths were attributed to Freda--five of which occurred in Luzon, the other two in Hong Kong.

One of the remarkable features associated with Freda were the comments by reconnaissance crews of the lack of a wall cloud around the eye, while she generated sustained winds of typhoon force. Fett (1968) described similar circumstances for typhoon Billie in 1967.

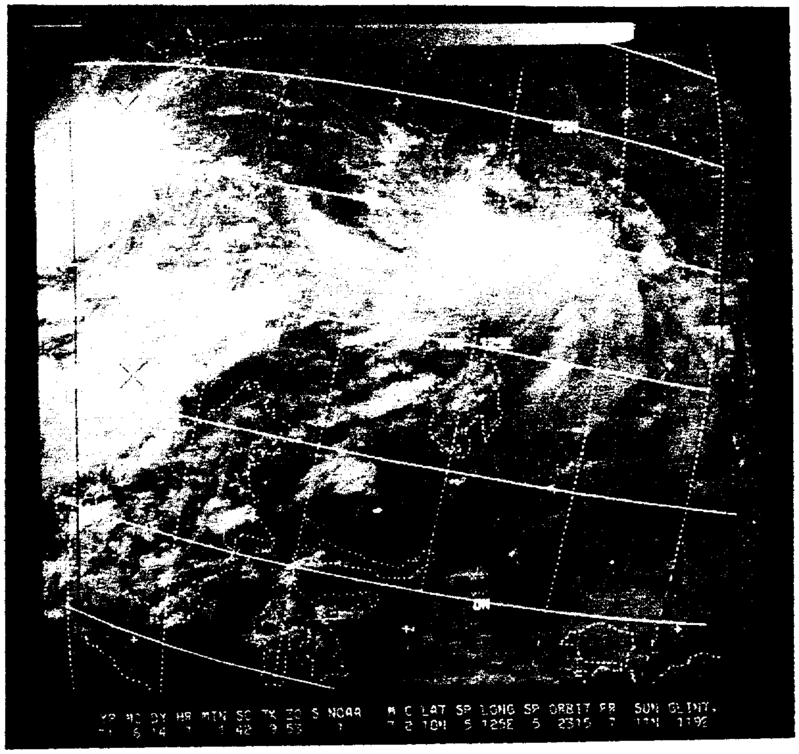


FIGURE 5-13. NOAA-1 CAMERAS PHOTOGRAPH FREDA AS A TROPICAL STORM EAST OF LUZON ON 14 JUNE.

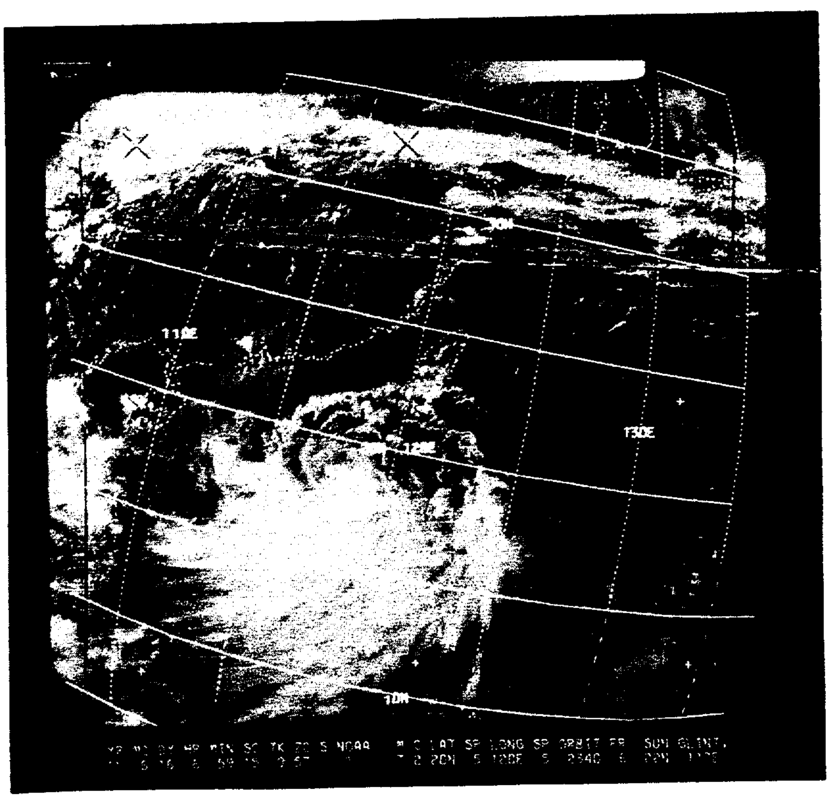


FIGURE 5-14. TYPHOON FREDA IN THE NORTHERN SOUTH CHINA SEA AS VIEWED BY NOAA-1 ON 16 JUNE.

TYPHOON FREDA
EYE FIXES FOR CYCLONE NO. 10
14 JUN - 18 JUN 71

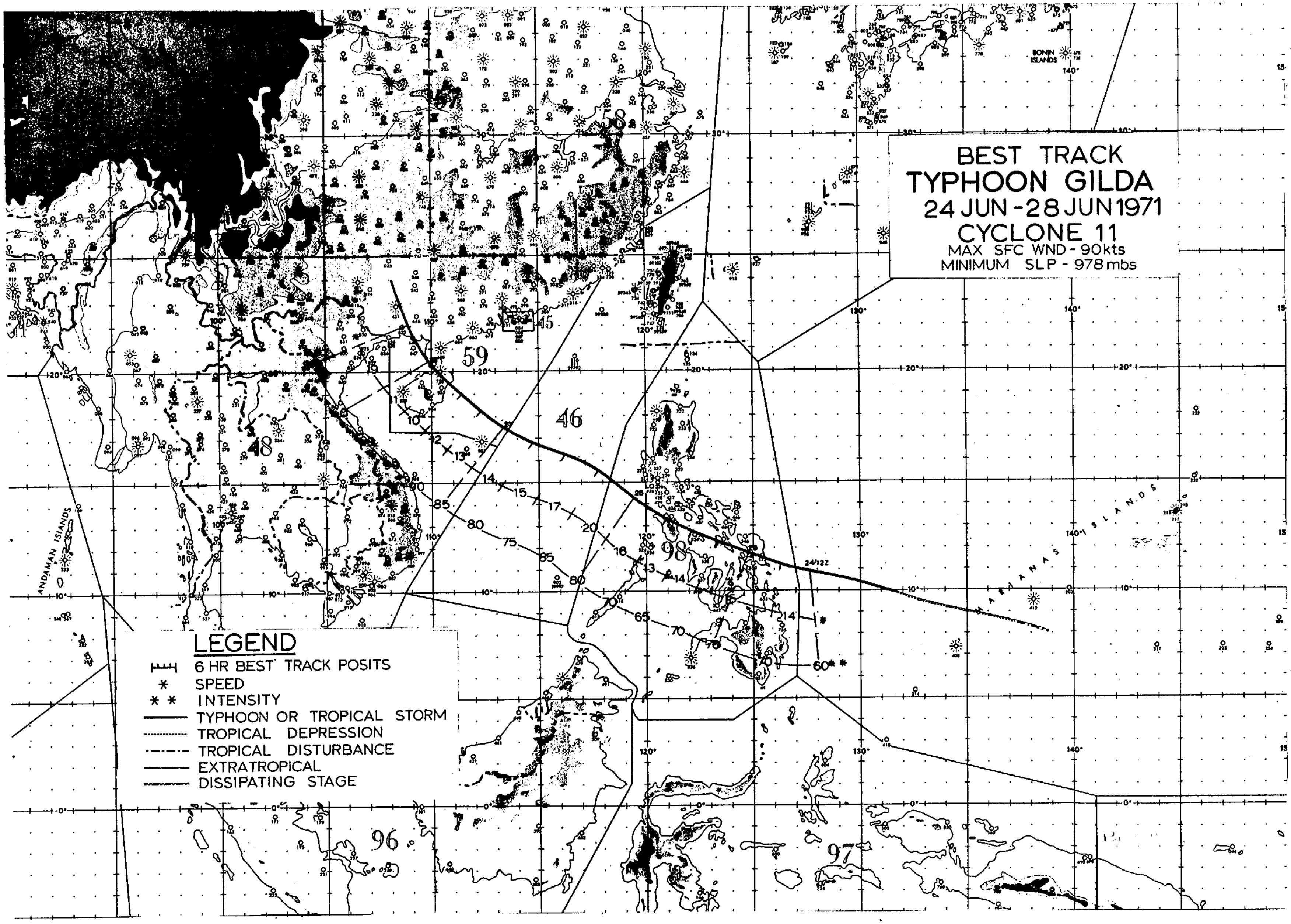
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	110515Z	8.7N 133.5E	VQ-P- 5---	700MB	27	25	1006	3112	13/12	----	-----	--	--	RDR PRES POOR	
2	120708Z	8.0N 132.0E	SATELIT---	STG B											
3	140701Z	15.5N 126.0E	SATELIT---	STG C											
4	140734Z	15.5N 126.4E	VQ-P- 8- 5	400M	----	40	1001	----	26/23	ELIP	E-W	50X27	--	WC OPEN N SEMIC	
5	141915Z	16.5N 124.7E	VQ-P- 5---	400M	----	60	993	----	26/23	ELIP	E-W	55	--	WC OPEN N SEMIC	
6	142210Z	16.4N 124.0E	VQ-P-20---	400M	----	50	994	----	26/23	----	-----	--	--	WC OPEN NE SEMIC	
7	150110Z	16.7N 123.6E	54-P- 5---	700MB	55	70	987	2987	12/11	----	-----	--	--	NEG RDR PRES	
8	150400Z	16.8N 123.0E	54-P- 1---	700MB	50	----	986	2975	14/12	----	-----	--	--	POOR RDR PRES	
9	150637Z	17.1N 122.7E	54-P- 1---	700MB	42	60	985	2978	15/12	----	-----	--	--	POORLY DEFINED	
10	150800Z	16.5N 122.0E	SATELIT---	STG X	DIA	3	CAT 2.0							EYE NOT VISIBLE	
11	151014Z	17.3N 122.4E	VQ-P- 3---	700MB	75	65	990	2975	16/15	CIRC		10	--	POOR RDR PRES	
12	151319Z	17.3N 121.8E	VQ-P-10---	700MB	55	----	----	----	15/13	----	-----	--	--	NEG RDR PRES	
13	151603Z	17.6N 121.3E	VQ-P- 8---	700MB	50	----	973	2978	11/09	----	-----	--	--	NEG RDR PRES	
14	152200Z	17.6N 119.9E	54-P-11-10	500MB	40	----	993	----	00/-3	----	-----	--	--	NEG RDR PRES	
15	160300Z	18.7N 118.9E	54-P- 6- 5	700MB	50	65	988	2996	15/10	----	-----	--	--	WC FORMING SE	
16	160659Z	18.5N 117.5E	SATELIT---	STG C+										LESS INTENSE	
17	161010Z	19.3N 117.6E	VQ-P- 3---	400M	65	70	----	2986	26/21	CIRC		25	--	WC OPEN N QUAD	
														STG FBS S SEMIC	
18	161300Z	19.6N 116.9E	VQ-P- 5---	400M	45	50	989	----	27/24	CIRC		35	5	WC OPEN NW	
19	161530Z	19.9N 116.4E	VQ-P- 5---	400M	65	65	988	----	27/24	----	-----	--	--	WC OPEN N-STG FBS	
20	161800Z	19.8N 116.2E	LND RDR---							----	-----	--	--	HK RDR-POOR FIX	22.3N 114.2E
21	162100Z	20.2N 116.0E	LND RDR---							----	-----	--	--	HK RDR-POOR FIX	22.3N 114.2E
22	162200Z	20.1N 115.3E	LND RDR---							----	-----	--	--	HK RDR-POOR FIX	22.3N 114.2E
23	170030Z	20.4N 115.5E	54-P- 1---	700MB	58	55	978	2920	16/10	CIRC		10	--	NO RDR PRES - 700	
														CNTR 4NM N	
24	170626Z	20.8N 115.0E	VQ-P- 5---	550M	----	60	984	----	27/22	ELIP	E-W	50X26	12	RDR PRES FAIR	
25	170753Z	20.0N 114.5E	SATELIT---	STG X	DIA	2	CAT 2.5							EYE NOT VISIBLE	
26	170930Z	21.3N 114.7E	VQ-R-12---	-----	----	45	----	----	--/25	CIRC		32	10	CLSD WC-STRONGER	21.0N 116.2E
27	171105Z	21.4N 114.8E	VQ-R-25---	-----	----	52	----	----	--/24	CIRC		35	7	WC OPEN NE QUAD	21.1N 115.6E

TYPHOON FREDA

1200Z 14 JUN TO 0000Z 18 JUN

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
141200Z	15.9N 125.6E	45	16.0N 125.8E	40	13	-5	17.7N	123.0E	50	69	-10	19.1N	120.0E	60	166	-5	20.2N	116.8E	70	155	15
141800Z	16.3N 124.7E	55	16.4N 124.9E	50	13	-5	18.3N	121.1E	55	30	-20	19.6N	118.0E	60	109	-5	--.-	---.-	--	--	--
150000Z	16.7N 123.8E	60	16.7N 123.8E	50	0	-10	18.3N	119.8E	55	13	-5	19.9N	116.3E	65	49	0	21.6N	113.6E	70	97	35
150600Z	17.1N 122.8E	65	16.8N 122.7E	70	19	5	18.1N	118.8E	50	61	-15	19.8N	115.5E	65	64	5	--.-	---.-	--	--	--
151200Z	17.5N 121.8E	60	17.3N 122.0E	60	17	0	18.4N	118.3E	50	99	-15	20.1N	115.0E	60	90	5	--.-	---.-	--	--	--
151800Z	17.8N 121.0E	75	17.5N 120.9E	50	19	-25	19.0N	117.1E	55	82	-10	20.9N	113.9E	65	78	15	--.-	---.-	--	--	--
160000Z	18.5N 119.7E	60	17.8N 119.5E	45	43	-15	19.6N	115.8E	55	49	-10	21.6N	113.2E	65	96	30	--.-	---.-	--	--	--
160600Z	19.0N 118.3E	65	18.8N 118.3E	65	12	0	20.9N	114.0E	85	62	25	--.-	---.-	--	--	--	--.-	---.-	--	--	--
161200Z	19.6N 117.1E	65	19.4N 117.1E	70	12	5	21.7N	113.1E	80	73	25	--.-	---.-	--	--	--	--.-	---.-	--	--	--
161800Z	20.0N 116.1E	65	20.1N 115.9E	70	13	5	22.8N	111.9E	40	111	-10	--.-	---.-	--	--	--	--.-	---.-	--	--	--
170000Z	20.4N 115.6E	65	20.4N 115.5E	75	6	10	22.8N	112.8E	50	36	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
170600Z	20.8N 115.1E	60	20.7N 115.1E	70	6	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
171200Z	21.5N 114.4E	55	21.3N 114.5E	65	13	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
171800Z	22.2N 113.8E	50	21.8N 113.9E	65	25	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
180000Z	23.2N 113.3E	35	22.7N 113.2E	35	30	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	16NM	62NM	93NM	126NM	16NM	62NM	93NM	126NM
AVERAGE RIGHT ANGLE ERROR	11NM	38NM	32NM	28NM	11NM	38NM	32NM	28NM
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	15KTS	9KTS	25KTS	8KTS	15KTS	9KTS	25KTS
AVERAGE BIAS OF WIND ERROR	0KTS	-3KTS	6KTS	25KTS	0KTS	-3KTS	6KTS	25KTS
NUMBER OF FORECASTS	15	11	7	2	15	11	7	2


BEST TRACK
TYPHOON GILDA
24 JUN - 28 JUN 1971
CYCLONE 11
MAX SFC WND - 90kts
MINIMUM SLP - 978 mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
ANDAMAN ISLANDS
MARIANAS ISLANDS
BONIN ISLANDS

GILDA

Gilda developed to tropical storm force 300 miles east of Leyte on June 24th. Her origin dates back to a circulation noted on the synoptic charts on the 18th south of Yap. During the next four days the system took a west-northwest intercept course with the central Philippines (Figure 5-15).

Reaching typhoon force just before striking Samar the morning of the 25th, she crossed Masbate Island, the Sibuyon Sea, Mindoro and crossed back to sea near Lubang Island. Maximum wind gusts of 90 kt were reported at Romblon in the Sibuyon Sea, while a maximum rainfall amount of 7.44 inches fell at Borongon. One person was reported killed and over 790 homes were destroyed.

Gilda did not drop below typhoon force during her transit through the Philippines, and emerged into the South China Sea with winds of 85 kt on the 26th. Shifting to a more northwesterly track at 15 kt, the typhoon struck north-eastern Hainan Island (Figure 5-16) 36 hours later with winds of 90 kt. Gilda moved ashore on mainland China, west of the Luichow peninsula, as a tropical storm on the 28th finally dissipating in the interior.

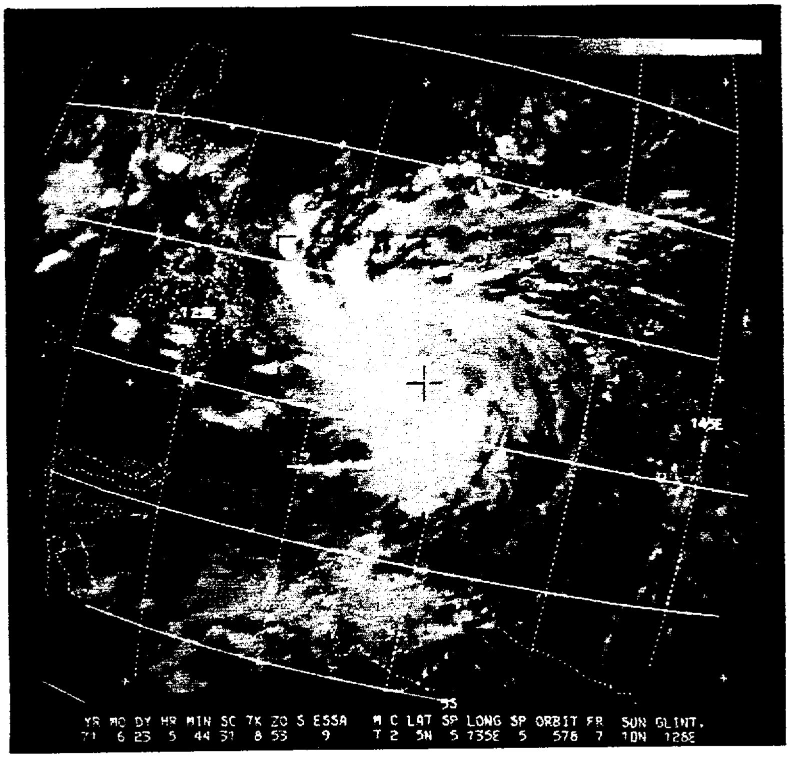


FIGURE 5-15. THE FORMATIVE STAGES OF TROPICAL STORM GILDA IN THE SOUTHERN PHILIPPINE SEAS AS SIGHTED BY ESSA-9 ON 23 JUNE.

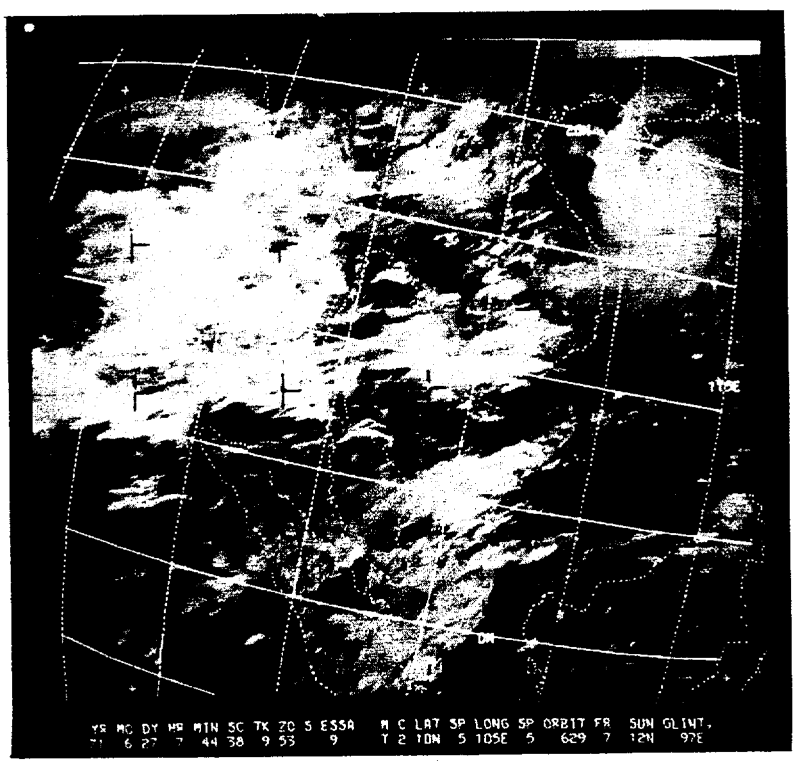


FIGURE 5-16. ESSA-9 PHOTO OF TYPHOON GILDA EAST OF HAINAN ISLAND ON 27 JUNE.

TYPHOON GILDA

EYE FIXES FOR CYCLONE NO. 11

24 JUN - 28 JUN 71

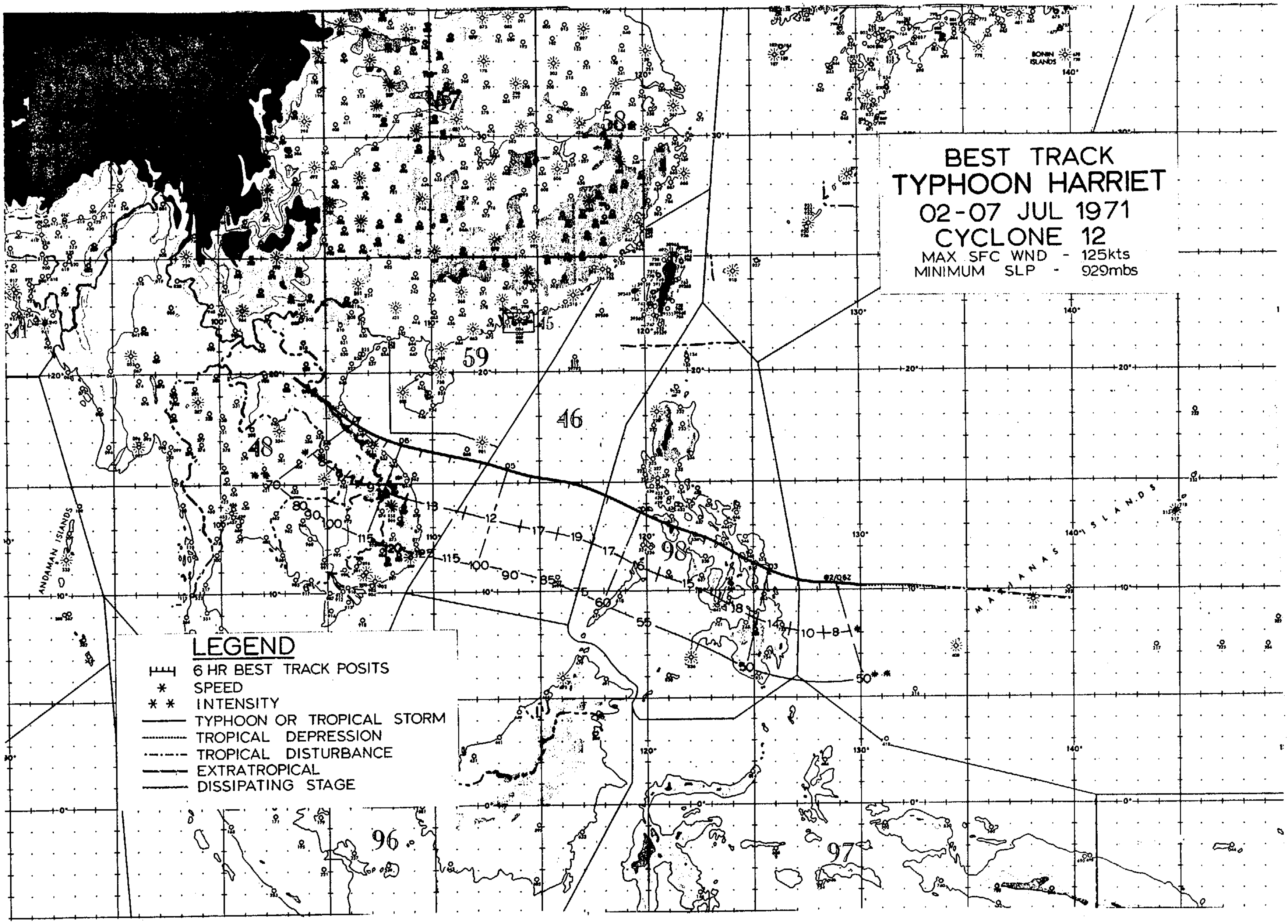
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	220634Z	8.0N 138.0E	SATELLI---	STG B											
2	230230Z	9.1N 134.4E	VQ-P-15---	500M	----	15	1005	----	26/23	CIRC		30	--	NO WC	
3	230545Z	8.5N 134.5E	SATELLI---	STG C										BETTER ORGANIZED	
4	240030Z	9.3N 130.7E	54-P-15---	700MB	30	25	1001	3057	08/07	----	-----	--	--	NEG RDR PRES	
5	240200Z	10.1N 130.6E	54-P------	-----	----	----	----	----	--/--	----	-----	--	--		
6	240644Z	11.5N 128.5E	SATELLI---	STG C										STRONGER	
7	241245Z	11.0N 127.4E	54-P- 5---	500M	55	----	985	2978	14/--	ELIP	E-W	18X10	5	FBS FORMING	
8	241600Z	11.2N 127.1E	54-P- 8---	700MB	68	----	986	2966	15/11	ELIP	N-S	15X12	5	WC RAGGED	
9	242215Z	11.4N 125.2E	54-P- 2---	700MB	80	----	----	----	16/10	CIRC		--	10	STG FBS F-SW	
10	250100Z	11.8N 124.5E	54-P- 1---	700MB	78	50	----	----	14/11	CIRC		--	10	WC POORLY DEF	
11	250415Z	12.1N 124.0E	54-P- 1---	700MB	70	70	----	----	09/08	----	-----	--	--	NEG WC	
12	250547Z	12.5N 123.5E	SATELLI---	STG X	DIA	3	CAT 2.0							STRONGER	
13	250720Z	12.3N 122.8E	VQ-P-15---	700MB	30	----	991	3084	14/10	----	-----	--	--	NEG RDR PRES	
14	251400Z	13.0N 121.8E	LND RDR---							----	-----	--	--	UNK SITE	
15	251622Z	13.2N 121.3E	54-P- 5---	500MB	50	----	----	----	00/-4	CIRC		20	--	WC OPEN NW	
16	251923Z	13.9N 120.4E	54-P- 3-12	500MB	50	----	----	----	00/-3	CIRC		18	10	CLSD WC	
17	252115Z	13.8N 120.2E	54-P- 2---	500MB	75	----	----	----	-1/-6	CIRC		10	10	CLSD WC-FBS E	
18	252250Z	14.0N 119.7E	SHP RDR---							----	-----	--	--	AN/SPS-30 RDR	
19	260000Z	14.4N 119.4E	SHP RDR---							----	-----	--	--	AN/SPS-30 RDR	
20	260100Z	14.6N 118.9E	SHP RDR---							----	-----	--	--	AN/SPS-30 RDR	
21	260110Z	14.5N 119.2E	54-P- 3---	700MB	90	----	----	----	19/12	CIRC		10	--	CLSD WC-STG FBS	
22	260400Z	15.1N 118.4E	54-P- 3- 2	700MB	90	100	----	2900	18/10	CIRC		15	--	WC OPEN NW	
23	260650Z	15.3N 118.0E	SATELLI---	STG X	DIA	2	CAT 2.5							LITTLE CHG	
24	261014Z	16.1N 116.4E	VQ-R- 5- 1	700MB	----	70	984	2987	17/12	CIRC		12	2	WC OPEN N	
25	261248Z	16.4N 116.1E	VQ-R- 5- 3	700MB	----	----	987	2996	15/11	CIRC		18	6	WC OPEN S QUAD	
26	262300Z	17.3N 113.5E	VQ-R- 3- 1	700MB	70	75	----	2874	19/11	CIRC		15	5	WC OPEN W	
27	270100Z	17.6N 113.1E	VQ-R- 3- 1	700MB	80	85	975	2868	19/11	CIRC		20	5	RDR PRES	
28	270400Z	17.9N 112.7E	VQ-R- 3- 1	700MB	90	90	----	2859	18/15	CIRC		20	--	WC OPEN S-NW	
29	270655Z	18.4N 112.1E	VQ-R- 5- 5	300M	----	65	----	----	--/16	----	-----	--	--	WC OPEN N	
30	270745Z	18.5N 112.0E	SATELLI---	STG X	DIA	3	CAT 3.0							RAGGED EYE	
31	271000Z	18.9N 111.4E	VQ-R- 3- 5	330M	----	65	----	----	--/--	CIRC		12	--	ONLY FRAGMENTS OF WC-HVY FBS E-S	19.1N 113.0E
32	271130Z	19.2N 111.1E	VQ-R-10- 5	300M	----	60	----	----	--/--	----	-----	--	--	NEG WC	
33	272100Z	20.0N 110.4E	----------	-----	----	----	974	----	--/--	----	-----	--	--	PSG OVR LND STN	

TYPHOON GILDA

1200Z 24 JUN TO 0600Z 28 JUN

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
241200Z	10.9N 127.7E	60	10.9N 127.6E	55	6	-5	13.5N 122.3E	60	43	-5	16.4N 118.3E	70	121	-5	19.4N 115.6E	75	244	-15
241800Z	11.3N 126.2E	70	11.3N 126.7E	65	29	-5	13.4N 122.5E	60	99	-10	15.9N 118.9E	65	247	-15	--.- ---.-	--	--	--
250000Z	11.8N 124.8E	70	11.7N 124.8E	65	6	-5	14.3N 119.5E	65	6	-15	17.8N 115.9E	75	150	-10	21.3N 113.8E	75	228	15
250600Z	12.2N 123.3E	70	12.2N 123.6E	65	18	-5	15.1N 118.5E	70	47	-15	18.8N 115.2E	80	174	-10	--.- ---.-	--	--	--
251200Z	12.8N 122.1E	65	12.8N 121.9E	60	12	-5	16.4N 117.2E	75	58	0	20.3N 114.3E	80	186	-10	--.- ---.-	--	--	--
251800Z	13.4N 120.8E	70	13.3N 120.9E	60	8	-10	16.8N 116.8E	75	120	-5	20.5N 114.2E	80	208	0	--.- ---.-	--	--	--
260000Z	14.3N 119.4E	80	14.4N 119.8E	65	24	-15	17.9N 115.8E	75	145	-10	21.8N 113.7E	70	231	10	--.- ---.-	--	--	--
260600Z	15.5N 117.8E	85	15.5N 118.0E	85	12	0	19.5N 114.5E	90	151	0	23.1N 113.7E	65	277	20	--.- ---.-	--	--	--
261200Z	16.3N 116.2E	75	16.5N 116.1E	80	13	5	20.7N 113.4E	80	156	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
261800Z	16.8N 114.7E	80	17.2N 115.1E	80	33	0	21.1N 112.4E	80	131	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
270000Z	17.4N 113.3E	85	17.4N 113.3E	80	0	-5	20.5N 109.1E	60	39	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
270600Z	18.2N 112.2E	90	18.1N 112.3E	90	8	0	22.0N 109.4E	40	34	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
271200Z	19.0N 111.3E	90	19.3N 111.1E	85	21	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
271800Z	19.7N 110.6E	80	20.2N 110.2E	60	37	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
280000Z	20.5N 109.8E	60	20.4N 110.2E	60	23	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
280600Z	22.1N 108.8E	45	22.0N 108.9E	50	8	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	16NM	86NM	199NM	236NM	16NM	86NM	199NM	236NM
AVERAGE RIGHT ANGLE ERROR	10NM	62NM	143NM	180NM	10NM	62NM	143NM	180NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	6KTS	10KTS	15KTS	6KTS	6KTS	10KTS	15KTS
AVERAGE BIAS OF WIND ERROR	-4KTS	-6KTS	-3KTS	0KTS	-4KTS	-6KTS	-3KTS	0KTS
NUMBER OF FORECASTS	16	12	8	2	16	12	8	2


BEST TRACK
TYPHOON HARRIET
02-07 JUL 1971
CYCLONE 12
MAX SFC WND - 125kts
MINIMUM SLP - 929mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
ANDAMAN ISLANDS
MARIANAS ISLANDS
BONIN ISLANDS

HARRIET

Harriet's incipient stages trace to a formative circulation in the equatorial trough in the vicinity of Yap while Gilda was traversing the South China Sea. By the 30th the circulation began to move westward reaching tropical storm force midway between the Leyte Gulf and the Palau Islands.

Accomplishing landfall in the Leyte Gulf near Tacloban around noon on the 3rd packing 50-kt winds, Harriet cut through the central Philippine Islands at a rate of 15 kt. After crossing Mindoro Island 24 hours later, further development was evident as the Manila Weather Bureau radar began to detect an eye. Typhoon force was gained in a matter of hours as she moved out to sea (Figure 5-17). Harriet continued on a west-northwest heading while the central pressure dropped in a 24-hour period between the 4th and 5th to 929 mb* which was measured by reconnaissance aircraft south of the Paracel Islands. Maximum winds estimated at this time were 125 kt (Figure 5-18). The occurrence of such rapid deepening is a rather rare event in the South China Sea. Fortunately, Harriet began to slow and weaken before reaching the Vietnam coast. By the morning of the 7th winds dropped to near 70 kt as the storm made landfall.

Moving into the DMZ, the typhoon literally washed out the war on Vietnam's northern front. Harriet, preceeded by day-long rains and high winds in the northern provinces, blotted out ground fighting and heavily cut into U.S. air strikes. A maximum 24-hour rainfall of 10.16 inches fell at Camp Evans which also registered sustained winds of 45 kt and gusts to 61 kt in the typhoon's southern quadrant.

In her aftermath, Harriet left one dead in the Philippines and four persons killed, 14 reported missing in Vietnam. Thua-thien Province in Vietnam suffered over 2,500 houses and buildings partly or completely destroyed.

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*Pressure of 921 recorded at 051310Z considered in error as recomputation from minimum 700-mb height checks at 932 mb.

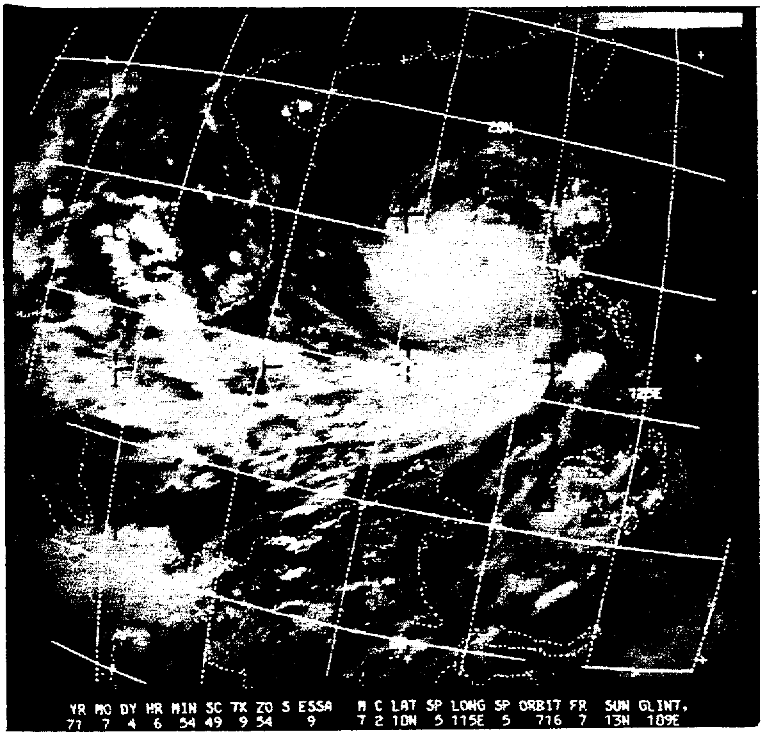


FIGURE 5-17. ESSA-9 VIEW OF TYPHOON HARRIET WEST OF LUZON ON 4 JULY.

FIGURE 5-18. TYPHOON HARRIET ON 5 JULY IS PHOTOGRAPHED BY ESSA-9.

TYPHOON HARRIET

EYE FIXES FOR CYCLONE NO. 12

02 JUL - 07 JUL 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/T0	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	300459Z	10.5N 136.0E	SATELIT---	STG B										HVY BAND ABT CNTR	
2	010447Z	11.3N 131.4E	54-P------	-----	----	25	1001	----	--/--	----	-----	--	--	INVESTIGATIVE FLT	
3	010554Z	10.0N 132.5E	SATELIT---	STG B										STRONGER	
4	020400Z	10.1N 129.2E	54-P- 3---	700MB	----	70	994	3030	12/--	----	-----	--	--	WC FORMING	
5	021000Z	10.4N 128.5E	54-P- 3- 3	700MB	50	70	991	3005	13/11	CIRC		20	10	WC CLSD-700 CNTR 14 NM NW-HVY FBS	
6	021520Z	10.4N 127.3E	VQ-P- 3- 5	700MB	45	50	996	3051	24/22	CIRC		17	3	WC OPEN S-HVY FBS	
7	022115Z	10.7N 126.4E	VQ-P- 2---	700MB	45	----	991	3011	14/10	ELIP	NE-SW	26X11	5	WC OPEN NW	
8	030400Z	11.5N 124.4E	54-P- 5---	500MB	40	----	----	----	-5/-5	----	-----	--	--	POORLY DEF-SFC CNTR 20 NM S	
9	030650Z	11.8N 123.8E	54-P- 5---	500MB	55	----	----	----	-4/-6	----	-----	--	--	NO RADAR PRES	
10	031005Z	12.2N 123.0E	54-P-10---	500MB	50	----	----	----	-5/-6	----	-----	--	--	NO RADAR PRES	
11	031230Z	12.6N 122.7E	LND RDR---							----	-----	--	--	UKN SITE	
12	031315Z	12.8N 122.2E	54-P-10---	500MB	50	----	----	----	00/-2	CIRC		8	--	POORLY DEF-RDR PRES IMPROVING	
13	031330Z	12.7N 122.2E	LND RDR---							----	-----	--	--	UKN SITE	
14	031430Z	12.9N 121.6E	LND RDR---							----	-----	--	--	UKN SITE	
15	031615Z	12.8N 121.6E	54-P- 1---	500MB	60	----	----	----	+2/-1	CIRC		6	--	RDR PRES POOR	
16	031900Z	13.0N 120.6E	54-P- 0---	500MB	50	----	----	----	-1/-2	----	-----	--	--	VERY POOR PRES	
17	032210Z	13.1N 120.4E	VQ-R- 4---	-----	55	50	----	----	--/10	ELIP	N-S	20X11	5	WC S SEMIC	13.9N 119.8E
18	040127Z	13.7N 119.4E	VQ-P-10---	700MB	----	55	980	2960	18/09	CIRC		33	5	CLSD WC-HVY FBS	
19	040404Z	14.2N 118.5E	54-P- 4- 7	700MB	70	90	972	2935	18/09	CIRC		25	10	CLSD WC-HVY FBS	
20	040655Z	15.0N 117.5E	SATELIT---	STG X	DIA	4	CAT 3.5								
21	040711Z	14.4N 117.9E	54-P- 3---	700MB	70	90	976	2896	17/10	CIRC		30	5	CLSD WC-700 MB CNTR 10NM W	
22	041002Z	14.8N 117.0E	54-P- 3---	700MB	90	100	974	2877	17/10	ELIP	E-W	30X20	5	WC OPEN N-700 CNTR 4NM W	
23	041301Z	15.0N 115.9E	54-P- 3---	700MB	90	----	974	2868	17/11	ELIP	E-W	35X20	5	WC OPEN N-MDT FBS	
24	041523Z	15.2N 115.4E	VQ-R- 3---	-----	----	100	----	----	--/25	CIRC		18	15	CLSD WC	15.2N 114.5E
25	042210Z	15.3N 113.9E	VQ-P- 5- 2	400M	----	100	----	----	27/21	CIRC		23	9	CLSD WC	
26	050200Z	15.6N 113.1E	SHP RDR---							----	-----	--	--	USS ORISKANY	15.0N 110.4E
27	050300Z	15.8N 112.7E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.1N 110.5E
28	050400Z	15.8N 112.7E	54-P- 1- 5	700MB	75	100	947	2399	19/15	CIRC		15	15	CLSD WC-V INTENSE	
29	050400Z	16.0N 112.5E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.4N 110.5E
30	050700Z	15.9N 111.9E	54-P- 1- 5	700MB	85	100	937	2539	19/11	CIRC		20	--	CLSD WC	
31	050700Z	16.1N 111.8E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.8N 110.9E
32	050735Z	16.0N 111.5E	SATELIT---	STG X	DIA	3	CAT 3.5							STRONGER	
33	050800Z	16.1N 111.6E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.6N 111.1E
34	050900Z	16.2N 111.4E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.7N 111.0E
35	050915Z	16.0N 111.5E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
36	050945Z	16.1N 111.5E	54-P- 1- 3	700MB	100	120	929	2484	24/11	CIRC		12	--	CLSD WC-TOPS 25K	
37	051000Z	16.2N 111.3E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.5N 111.1E
38	051100Z	16.3N 111.1E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.6N 110.9E
39	051145Z	16.1N 111.1E	LND RDR---							----	-----	17	--	DANANG RDR	16.0N 108.2E
40	051200Z	16.3N 110.8E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.7N 110.8E
41	051245Z	16.2N 110.7E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
42	051300Z	16.3N 110.6E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.9N 110.7E
43	051310Z	16.2N 110.8E	VQ-P- 7- 3	700MB	120	----	921	2499	23/15	CIRC		15	8	CLSD WC-TOPS 28K	
44	051343Z	16.3N 110.5E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
45	051400Z	16.4N 110.4E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.7N 110.6E

TYPHOON HARRIET
EYE FIXES FOR CYCLONE NO. 12
02 JUL - 07 JUL 71

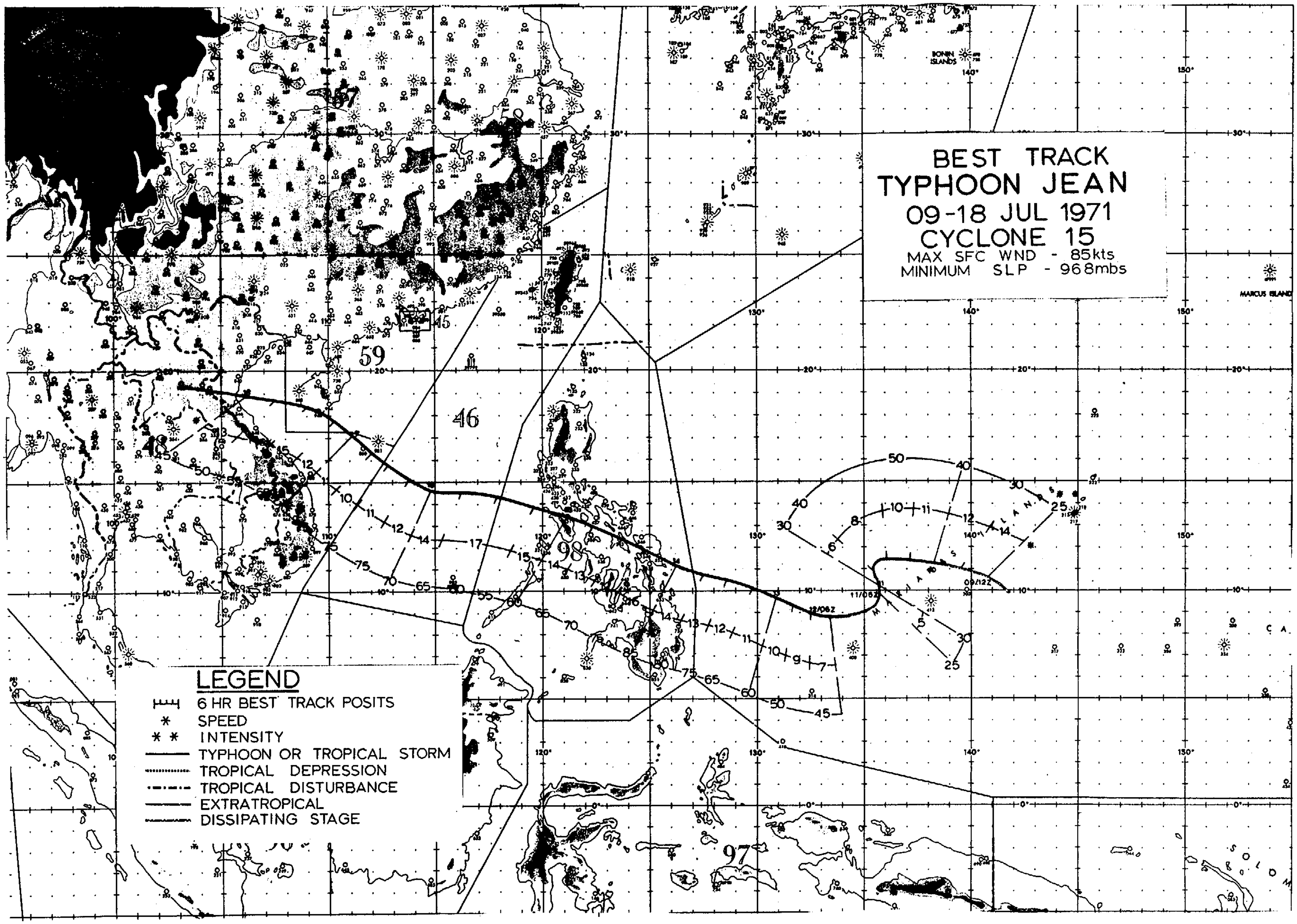
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
46	051458Z	16.4N 110.4E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
47	051500Z	16.4N 110.1E	SHP RDR---							----	-----	--	--	USS ORISKANY	13.9N 110.5E
48	051545Z	16.4N 110.1E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
49	051600Z	16.3N 110.0E	VO-R- 3- 3	-----	75	----	----	----	--/20	CIRC		15	8	CLSD WC TOPS 46K	
50	051600Z	16.4N 109.6E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.1N 110.5E
51	051700Z	16.5N 109.7E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.3N 110.5E
52	051800Z	16.4N 109.5E	VO-R- 3---	-----	55	60	----	----	--/25	CIRC		14	6	CLSD WC	16.2N 110.7E
53	051800Z	16.5N 109.6E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.5N 110.5E
54	051900Z	16.5N 109.5E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.6N 110.6E
55	052000Z	16.6N 109.0E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.8N 110.5E
56	052024Z	16.7N 109.3E	LND RDR---							----	-----	--	--	GOOD FIX	
57	052100Z	16.6N 109.2E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.8N 110.4E
58	052230Z	16.7N 108.8E	VO-P- 5---	700MB	----	----	924	2496	24/13	CIRC		20	7	WC OPEN NW	
59	052246Z	16.6N 109.0E	LND RDR---							----	-----	--	--	UKN SITE	
60	052300Z	16.6N 108.8E	SHP RDR---							----	-----	--	--	USS ORISKANY	14.9N 110.3E
61	052315Z	16.6N 108.9E	LND RDR---							----	-----	--	--	UKN SITE	
62	060000Z	16.7N 108.5E	SHP RDR---							----	-----	--	--	USS ORISKANY	15.2N 110.4E
63	060025Z	16.8N 109.0E	VO-P- 3- 1	700MB	----	----	933	2600	22/12	CIRC		20	6	WC OPEN NW	
64	060115Z	16.6N 108.6E	LND RDR---							CIRC		12	--	POOR FIX-DANANG	16.0N 108.2E
65	060215Z	16.6N 108.0E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
66	060300Z	16.7N 108.1E	SHP RDR---							----	-----	--	--		15.5N 110.5E
67	060328Z	16.7N 108.1E	VO-P- 3- 1	700MB	----	80	939	2652	20/12	CIRC		18	--	WC OPEN W	
68	060400Z	16.6N 108.1E	SHP RDR---							----	-----	--	--	POOR FIX	15.3N 110.6E
69	060415Z	16.7N 108.2E	LND RDR---							----	-----	15	--	UKN SITE	
70	061145Z	17.0N 107.6E	54-P- 1- 1	500MB	75	----	----	----	-3/-7	CIRC		12	4	CLSD WC	
71	070255Z	19.5N 108.0E	----------	-----	----	----	----	----	--/--	----	-----	--X 2	--	USS MIDWAY APT	
72	070600Z	19.5N 105.1E	----------	-----	----	----	----	----	--/--	----	-----	--	--	REMNANTS OF STORM	

TYPHOON HARRIET

0600Z 2 JUL TO 0000Z 7 JUL

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
020600Z	10.2N 128.8E	50	10.0N 129.0E	50	17	0	10.8N 125.1E	75	80	25	12.3N 121.4E	70	221	-5	--.- ---.-	--	--	--
021200Z	10.3N 128.1E	50	10.5N 128.2E	60	13	10	11.5N 124.4E	70	111	20	13.6N 121.4E	70	301	-15	15.7N 118.4E	70	432	-55
021800Z	10.5N 127.1E	50	10.6N 126.9E	60	13	10	12.1N 123.2E	65	121	10	14.4N 120.4E	65	333	-25	--.- ---.-	--	--	--
030000Z	10.8N 125.7E	50	10.8N 126.0E	60	18	10	12.7N 122.5E	60	164	0	15.2N 119.4E	65	340	-35	16.9N 115.9E	75	412	-40
030600Z	11.7N 124.1E	50	11.7N 124.0E	60	6	10	14.6N 120.1E	60	111	-15	16.7N 116.5E	75	245	-40	--.- ---.-	--	--	--
031200Z	12.5N 122.8E	50	12.6N 122.6E	60	13	10	15.9N 117.9E	70	102	-15	18.1N 113.4E	80	182	-45	20.6N 110.7E	80	276	-10
031800Z	12.9N 121.3E	55	12.9N 120.9E	60	23	5	15.7N 115.7E	75	65	-15	18.4N 112.2E	80	187	-40	--.- ---.-	--	--	--
040000Z	13.5N 119.8E	60	13.4N 120.0E	60	13	0	16.0N 115.3E	75	108	-25	18.5N 112.1E	80	221	-35	21.4N 110.5E	70	324	0
040600Z	14.3N 118.2E	75	14.4N 118.0E	70	13	-5	17.5N 113.1E	80	106	-35	20.7N 110.7E	80	277	-20	--.- ---.-	--	--	--
041200Z	15.0N 116.4E	85	15.2N 116.6E	85	17	0	18.8N 111.9E	90	165	-35	22.1N 110.4E	50	340	-40	--.- ---.-	--	--	--
041800Z	15.2N 114.7E	90	15.5N 114.7E	90	18	0	19.4N 110.3E	80	178	-40	23.2N 109.0E	40	372	-40	--.- ---.-	--	--	--
050000Z	15.5N 113.5E	100	15.4N 113.4E	95	8	-5	17.3N 108.3E	100	43	-15	19.8N 104.8E	60	143	-10	--.- ---.-	--	--	--
050600Z	15.9N 112.3E	115	15.9N 112.4E	100	6	-15	18.0N 108.3E	95	70	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051200Z	16.2N 110.9E	125	16.3N 111.0E	115	8	-10	18.7N 107.2E	115	97	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051800Z	16.5N 109.6E	120	16.5N 109.6E	115	0	-5	18.9N 105.5E	90	124	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060000Z	16.7N 108.7E	115	16.9N 108.6E	120	13	5	19.2N 105.3E	90	98	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	16.9N 107.9E	100	16.8N 107.8E	110	8	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	17.1N 107.5E	90	16.9N 107.5E	95	12	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	17.3N 106.9E	80	17.1N 106.9E	80	12	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	17.8N 106.2E	70	17.3N 106.6E	50	38	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORFCAST ERROR	13NM	109NM	264NM	361NM	13NM	109NM	264NM	361NM
AVERAGE RIGHT ANGLE ERROR	10NM	67NM	154NM	184NM	10NM	67NM	154NM	184NM
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	19KTS	29KTS	26KTS	7KTS	19KTS	29KTS	26KTS
AVERAGE BIAS OF WIND ERROR	1KTS	-6KTS	-29KTS	-26KTS	1KTS	-6KTS	-29KTS	-26KTS
NUMBER OF FORECASTS	20	16	12	4	20	16	12	4


BEST TRACK
TYPHOON JEAN
09-18 JUL 1971
CYCLONE 15
MAX SFC WND - 85kts
MINIMUM SLP - 968mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BONIN ISLANDS
MARCUS ISLAND

JEAN

As Jean came onto the scene, the Philippines and Vietnam became the target of July's second typhoon. From her incipient stage, a weak circulation southeast of Guam on the 9th, Jean spent her nine-day lifetime describing a track similar to Gilda and Harriet's.

Attaining 50-kt winds on the 10th, Jean weakened to depression status and described an erratic track for a 24-hour period, while the center showed a southward displacement. Regaining tropical storm strength north of the Palau Islands on the 11th, Jean commenced on a west-northwest track gradually increasing in forward speed (Figure 5-19).

The United Kingdom vessel SIMON BURN passed near the center the morning of the 13th reporting force-10 winds (48-55 kt), very high seas and a minimum sea level pressure of 987 mb.

Attaining typhoon strength that afternoon about 270 n mi east of Leyte, Jean reached a peak of 85 kt a few hours before striking Samar the following day. Jean cut across the central Philippines on the 14th and 15th with her winds dropping below typhoon strength as she emerged into the South China Sea near Lubang Island.

Highest winds reported in the archipelago were 65 kt at Catbalogan located on the western coast of Samar while gusts of 70 kt were measured at Virac on Catanduanes. Winds up to 38 kt were also experienced in high and exposed areas of the greater Manila area. Over 7 inches of rain fell in a two-day period in Samar. No reports of casualties and damage are available; however, low-lying areas of Manila encountered local flooding.

Regaining typhoon winds over open water about 24 hours later (Figure 5-20), the storm changed course to a northwesterly heading as she approached a weakness in the subtropical ridge. Skirting southern Hainan Island on the 17th, Jean's winds dropped to storm status. Bending back to a westerly course across the Gulf of Tonkin, the storm struck shore near Vinh on the Indochina coast on the 18th. The system dissipated over the mountainous terrain of Laos later that day.

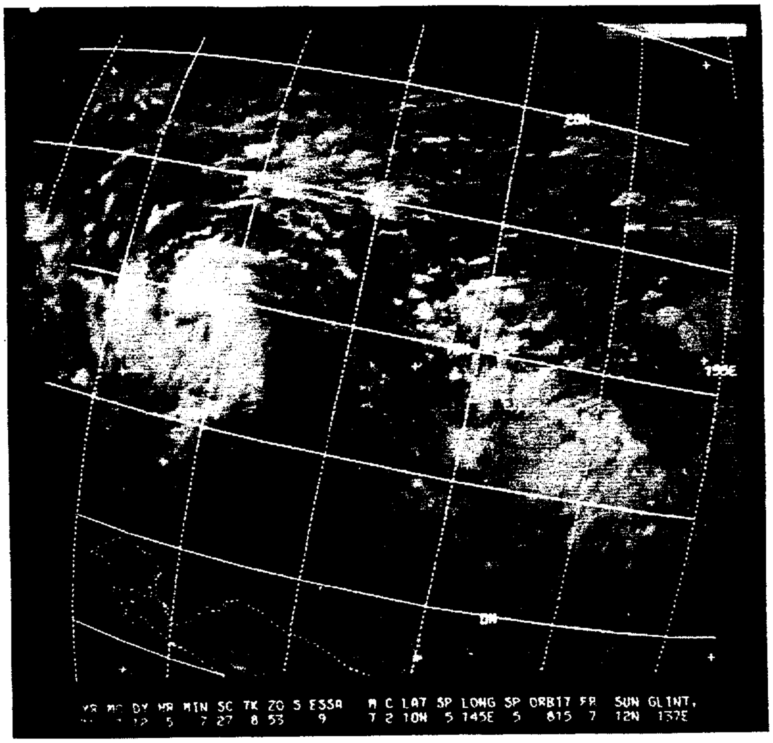


FIGURE 5-19. TROPICAL STORM STAGE OF JEAN AS SEEN ON 12 JULY BY ESSA-9.

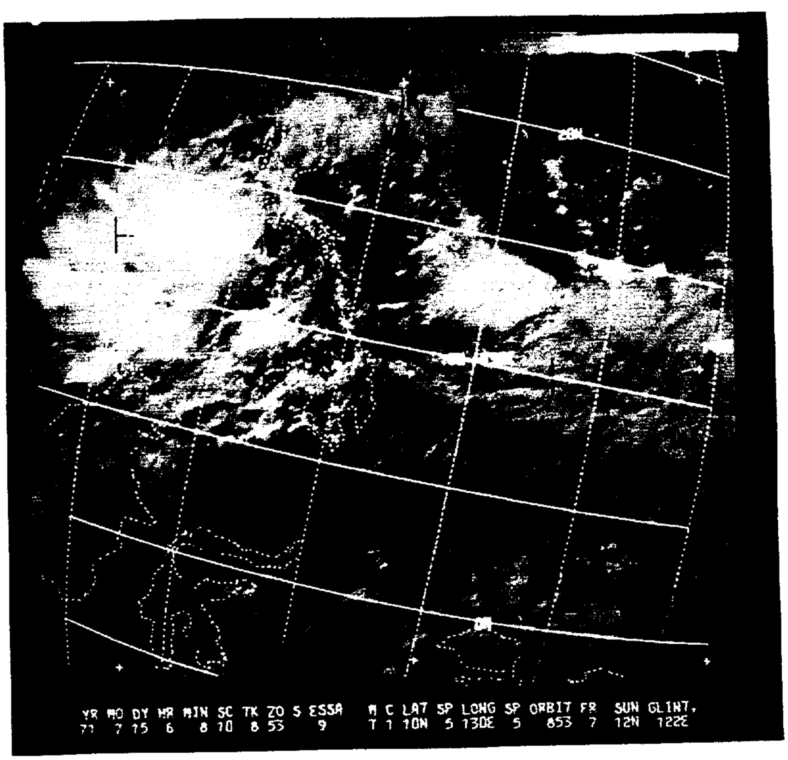


FIGURE 5-20. AS A MINIMAL TYPHOON, JEAN IS SIGHTED BY ESSA-9 ON 15 JULY AFTER CROSSING THE PHILIPPINES.

TYPHOON JEAN
EYE FIXES FOR CYCLONE NO. 15
09 JUL - 18 JUL 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	090602Z	10.5N 138.5E	SATELIT---	STG B										FIRST SAT BLTN	
2	100139Z	11.2N 137.8E	VQ-P- 3---	300M	45	45	1003	----	27/23	CIRC		20	--	NO WC-WK FBS	
3	100345Z	11.3N 137.4E	VQ-P- 3---	300M	60	60	1005	----	26/22	CIRC		18	--	WC OPEN F	
4	101000Z	11.3N 136.7E	54-P- 5- 3	700MB	49	35	998	3063	11/07	----	-----	--	--	WC FORMING	
5	101545Z	11.2N 135.3E	54-P- 2-15	700MB	50	----	1001	3070	09/08	----	-----	--	--	RDR PRES POOR	
6	110425Z	10.0N 136.0E	54-P- 1-19	700MB	40	20	1001	3072	09/08	----	-----	--	--	NEG RDR PRES	
7	110609Z	10.0N 135.0E	SATELIT---	STG B										BANDS TO S	
8	120159Z	8.9N 134.0E	VQ-P- 5-40	300M	----	45	998	----	27/25	----	-----	--	--	WC OPEN SW	
9	120507Z	9.0N 137.0E	SATELIT---	STG C+										STRONGER	
10	121033Z	8.9N 132.9E	54-P-15---	700MB	34	----	993	3024	12/11	CIRC		10	--	POORLY DEFINED	
11	121540Z	9.2N 132.0E	54-P-20---	700MB	42	----	993	3005	13/11	----	-----	--	--	NO WC	
12	122229Z	9.5N 131.2E	VQ-R- 8---	700MB	----	----	---*	----	--/--	CIRC		5	2	WC OPEN N	10.0N 131.4E
13	130304Z	9.8N 130.2E	VQ-R- 5- 3	700MB	----	----	---*	----	--/--	CIRC		5	4	CLSD WC	10.6N 130.1E
14	130606Z	10.0N 129.0E	SATELIT---	STG C+										LITTLE CHG	
15	131000Z	10.5N 129.2E	54-P- 5---	700MB	65	75	986	2987	18/12	CIRC		18	--	WC OPEN SW-N	
16	131600Z	10.6N 127.9E	54-P- 5- 4	700MB	40	----	983	2951	16/13	CIRC		25	10	CLSD WC	
17	131751Z	10.7N 127.5E	54-P- 5- 4	700MB	35	----	984	2932	16/12	CIRC		25	--	CLSD WC	
18	132200Z	11.0N 126.8E	54-P- 3- 2	700MB	80	85	977	2899	18/12	ELIP	E-W	30X25	--	CLSD WC	
19	140425Z	11.5N 124.6E	VQ-R-10---	700MB	45	50	---*	----	--/--	----	-----	--	--	NO WC-MDT FBS	
20	140505Z	11.8N 124.8E	VQ-P-10---	700MB	----	----	968	2819	14/11	----	-----	--	--	NO WC	
21	140705Z	12.0N 125.0E	SATELIT---	STG X	DIA	2	CAT 2.0							STRONGER	
22	140708Z	12.0N 124.8E	VQ-P- 2---	700MB	105	----	983	3001	17/12	----	-----	--	--	NO WC	
23	140935Z	12.2N 124.2E	VQ-P- 5---	700MB	86	----	984	2996	16/15	----	-----	--	--	NO WC	
24	141315Z	12.6N 123.4E	54-P- 1-40	500MB	55	----	---*	----	-4/--	----	-----	--	--	NO WC	
25	141600Z	12.7N 123.1E	54-R- 5-45	500MB	55	----	---*	----	--/-1	----	-----	--	--	NO WC	12.3N 123.0E
26	141820Z	12.6N 122.2E	54-R-10-40	500MB	40	----	---*	----	--/--	----	-----	--	--	FBS BGNG TO FORM	12.6N 121.3E
27	141900Z	12.7N 121.9E	LND RDR---							----	-----	--	--	ADCC RDR	15.2N 120.0E
28	142222Z	13.8N 120.8E	VQ-R-15---	300M	----	----	---*	----	--/--	CIRC		11	3	CLSD WC	13.5N 119.5E
29	150121Z	13.5N 119.6E	VQ-R- 3---	300M	----	----	---*	----	--/--	CIRC		8	--	CLSD WC	14.0N 119.2E
30	150345Z	13.4N 118.9E	VQ-R-10---	300M	----	----	---*	----	--/--	CIRC		8	2	WC OPEN W-MANY WATERSPOUTS NE	13.7N 118.8E
31	150608Z	13.0N 118.0E	SATELIT---	STG X	DIA	3	CAT 2.5								
32	150759Z	13.6N 118.7E	54-R-15---	700MB	55	----	---*	----	--/--	CIRC		30	18	MDT FBS	14.0N 119.7E
33	151015Z	14.1N 118.4E	54-P- 3- 5	700MB	55	45	982	2981	15/11	CIRC		10	--	NO WC-SFC CNTR 25 NM NE	
34	151300Z	14.4N 117.6E	54-P- 3---	700MB	110	----	989	2972	15/11	CIRC		8	10	WC OPEN N	
35	151555Z	14.4N 116.8E	54-P- 3- 5	700MB	100	----	985	2957	15/11	CIRC		10	8	WC OPEN E	
36	152200Z	14.6N 115.2E	54-P- 1- 9	700MB	50	70	983	2940	13/12	ELIP	E-W	30X20	5	POOR RDR PRES	
37	152230Z	14.5N 114.9E	SHP RDR---							----	-----	--	--	USS HORNE	
38	152330Z	14.5N 114.8E	SHP RDR---							----	-----	--	--	USS HORNE	
39	160030Z	14.3N 114.9E	SHP RDR---							----	-----	--	--	USS HORNE	
40	160130Z	14.3N 114.5E	SHP RDR---							----	-----	--	--	USS HORNE	
41	160230Z	14.3N 114.5E	SHP RDR---							----	-----	--	--	USS HORNE	
42	160330Z	14.4N 114.4E	SHP RDR---							----	-----	--	--	USS HORNE	
43	160400Z	14.7N 114.5E	54-P- 1- 9	700MB	60	70	979	2905	16/13	CIRC		40	5	WC OPEN NW	
44	160706Z	15.0N 114.0E	SATELIT---	STG X	DIA	2	CAT 2.5							MAIN CLD MASS SW	
45	161025Z	15.5N 113.2E	VQ-P- 5---	240M	----	110	977	----	27/26	CIRC		18	6	WC OPEN N-SST 29C	
46	161300Z	15.7N 112.4E	SHP RDR---							----	-----	--	--	USS HORNE	15.2N 109.8E
47	161315Z	15.8N 112.7E	VQ-P- 5---	260M	----	100	977	----	27/25	CIRC		22	6	WC OPEN E-NW	
48	161330Z	15.8N 112.5E	SHP RDR---							----	-----	--	--	USS HORNE	15.1N 109.9E

TYPHOON JEAN
EYE FIXES FOR CYCLONE NO. 15
09 JUL - 18 JUL 71

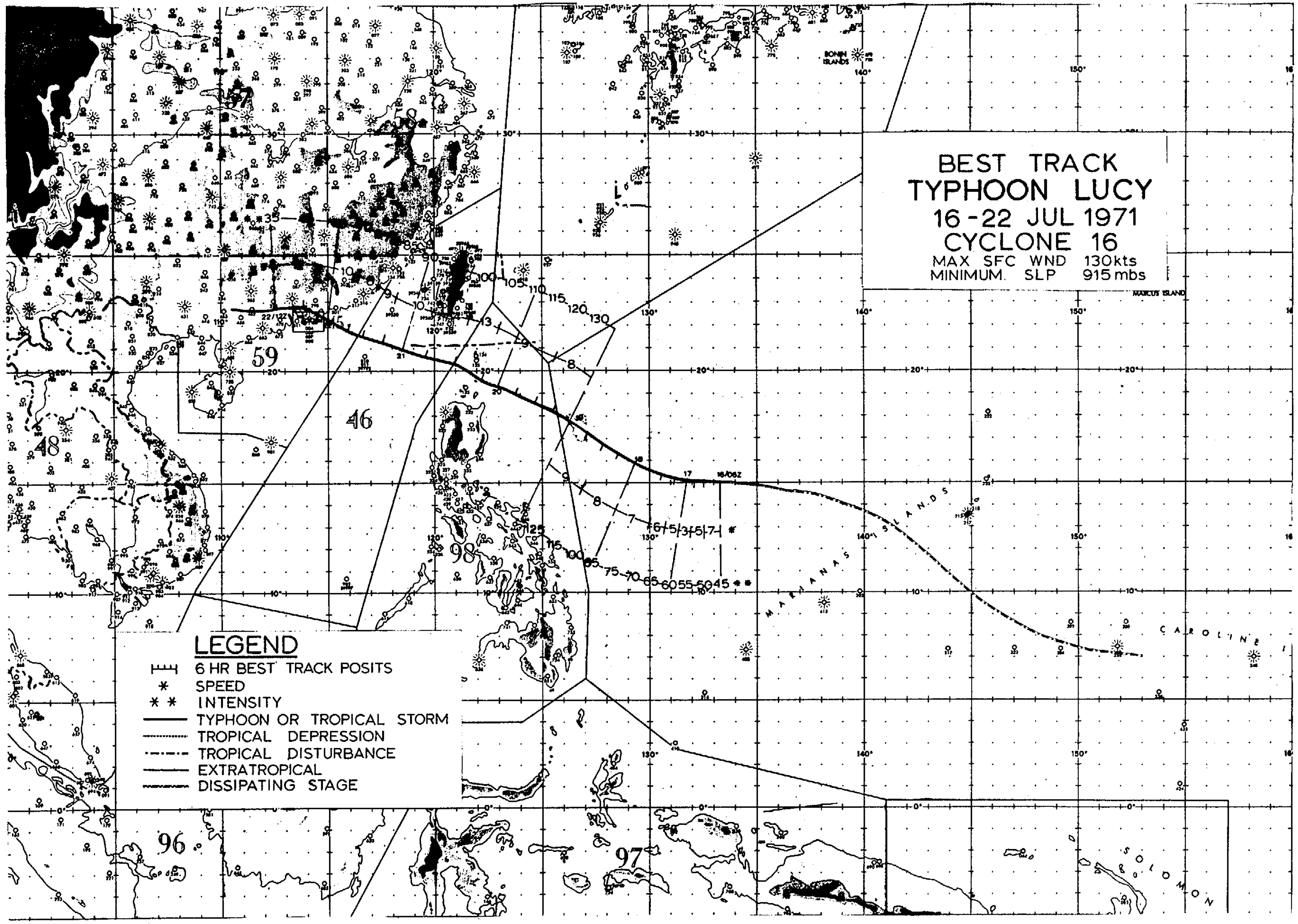
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
49	161400Z	15.8N 112.6E	SHP RDR---							----	-----	--	--	USS HORNE	15.0N 109.9E
50	161430Z	15.8N 112.5E	SHP RDR---							----	-----	--	--	USS HORNE	14.8N 109.9E
51	161550Z	16.0N 112.2E	VQ-R- 5---	700MB	----	90	----	----	--/13	ELIP	E-W	18X13	8	WC OPEN NW	16.7N 112.5E
52	161900Z	16.6N 111.8E	54-P- 1- 9	700MB	50	----	975	2896	16/12	----	-----	--	--	NEG RADAR PRES	
53	162200Z	16.7N 111.4E	54-P-10---	700MB	52	----	978	2896	15/12	----	-----	--	--	NEG RADAR PRES	
54	170100Z	17.1N 111.5E	54-P- 2-2H	700MB	58	65	----	----	--/--	----	-----	--	--	NEG RADAR PRES	
55	170528Z	17.2N 110.2E	VQ-R-15-12	-----	----	----	----	----	--/--	ELIP	N-S	12X 8	--	V POOR RDR PRES	16.1N 110.1E
56	170614Z	17.5N 110.0E	SATELIT---	STG X	DIA	3	CAT 3.0							EYE FAINTLY VSBL	
57	170700Z	18.1N 110.1E	VQ-R- 5- 5	-----	----	----	----	----	--/--	CIRC		12	--	EXC RDR PRES	16.6N 110.0E

TYPHOON JEAN

1200Z 9 JUL TO 0000Z 18 JUL

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
091200Z	10.5N 140.8E	25	10.2N 137.0E	30	224	5	11.8N 132.4E	55	219	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
091800Z	11.0N 139.4E	30	10.5N 136.0E	30	202	0	12.0N 132.0E	55	210	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100000Z	11.2N 138.2E	40	11.0N 138.0E	45	17	5	13.4N 133.6E	70	222	40	--.- ---.-	--	--	--	15.0N 121.7E	100	618	40
100600Z	11.3N 137.1E	50	11.5N 137.1E	50	12	0	13.6N 133.0E	85	276	60	14.8N 127.3E	100	501	55	--.- ---.-	--	--	--
101200Z	11.3N 136.1E	50	11.7N 136.5E	50	33	0	--.- ---.-	--	--	--	14.8N 127.6E	100	453	55	15.0N 121.5E	110	503	35
101800Z	10.9N 135.4E	40	11.5N 135.0E	50	43	10	--.- ---.-	--	--	--	13.5N 125.2E	100	461	50	--.- ---.-	--	--	--
110000Z	10.3N 135.7E	30	11.1N 134.2E	50	100	20	--.- ---.-	--	--	--	12.2N 125.5E	90	345	30	13.5N 120.0E	80	387	-5
110600Z	9.8N 135.7E	25	10.0N 136.0E	25	21	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
120600Z	8.8N 133.3E	45	9.0N 133.7E	45	26	0	9.7N 131.8E	60	120	-5	11.5N 128.2E	70	200	-5	--.- ---.-	--	--	--
121200Z	9.0N 132.6E	45	8.9N 132.6E	50	6	5	9.3N 129.3E	60	77	-15	11.0N 125.6E	80	139	10	13.8N 120.5E	70	153	10
121800Z	9.3N 131.8E	50	9.2N 131.7E	50	8	0	10.5N 127.6E	70	19	-10	12.6N 122.8E	75	29	10	--.- ---.-	--	--	--
130000Z	9.7N 130.8E	60	9.7N 131.0E	55	12	-5	11.1N 127.4E	75	71	-10	13.1N 122.8E	70	100	10	15.4N 117.5E	75	163	5
130600Z	10.1N 129.8E	65	10.1N 129.8E	65	0	0	11.9N 125.5E	80	41	5	14.1N 120.7E	70	66	15	--.- ---.-	--	--	--
131200Z	10.5N 128.8E	75	10.6N 128.8E	70	6	-5	12.5N 124.4E	75	41	5	14.8N 119.1E	70	78	10	16.8N 114.2E	85	104	10
131800Z	10.8N 127.5E	80	11.0N 127.7E	75	17	-5	13.1N 123.1E	75	42	10	15.4N 117.8E	75	107	10	--.- ---.-	--	--	--
140000Z	11.2N 126.2E	85	11.3N 126.5E	80	19	-5	13.3N 121.7E	70	35	10	15.7N 116.8E	80	133	10	17.3N 112.1E	85	53	15
140600Z	11.9N 124.8E	75	12.0N 124.7E	80	8	5	14.5N 119.5E	75	42	20	16.6N 114.5E	85	101	10	--.- ---.-	--	--	--
141200Z	12.4N 123.7E	70	12.4N 123.7E	80	0	10	14.9N 118.8E	80	67	20	16.8N 113.8E	90	87	15	18.3N 108.8E	90	13	35
141800Z	12.9N 122.4E	65	12.8N 122.7E	75	18	10	15.3N 118.0E	80	114	15	17.0N 113.4E	90	90	15	--.- ---.-	--	--	--
150000Z	13.4N 121.1E	60	13.9N 120.7E	75	38	15	16.1N 115.8E	85	107	15	17.5N 111.0E	95	26	25	18.8N 107.0E	85	52	40
150600Z	13.8N 119.6E	55	13.5N 118.6E	75	61	20	16.2N 114.6E	85	84	10	17.7N 110.3E	90	6	25	--.- ---.-	--	--	--
151200Z	14.2N 117.9E	60	14.5N 118.1E	75	21	15	16.3N 113.2E	85	43	10	17.7N 109.3E	90	53	35	--.- ---.-	--	--	--
151800Z	14.5N 116.2E	65	14.7N 116.3E	75	13	10	16.3N 111.7E	90	17	15	17.7N 107.7E	90	67	40	--.- ---.-	--	--	--
160000Z	14.6N 114.8E	70	14.8N 114.8E	75	12	5	16.7N 110.1E	90	67	20	18.3N 106.3E	80	43	35	--.- ---.-	--	--	--
160600Z	15.1N 113.7E	75	14.8N 114.1E	75	29	0	15.9N 109.4E	80	125	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161200Z	15.7N 112.8E	75	15.5N 112.8E	80	12	5	16.4N 108.0E	80	136	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161800Z	16.3N 112.0E	75	16.2N 111.9E	80	8	5	17.4N 107.8E	80	85	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170000Z	17.1N 111.2E	70	16.8N 111.0E	70	21	0	19.2N 107.6E	60	86	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170600Z	17.8N 110.3E	65	17.3N 110.1E	70	32	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
171200Z	18.5N 108.9E	55	18.4N 109.9E	60	57	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
171800Z	18.8N 107.5E	50	19.6N 108.0E	55	55	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
180000Z	19.0N 106.1E	45	20.3N 107.3E	50	103	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	25NM	84NM	154NM	227NM	39NM	98NM	154NM	227NM
AVERAGE RIGHT ANGLE ERROR	18NM	63NM	67NM	51NM	22NM	74NM	67NM	51NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	14KTS	24KTS	22KTS	6KTS	17KTS	24KTS	22KTS
AVERAGE BIAS OF WIND ERROR	4KTS	10KTS	23KTS	21KTS	5KTS	13KTS	23KTS	21KTS
NUMBER OF FORECASTS	28	22	20	9	32	24	20	9


BEST TRACK
TYPHOON LUCY
16-22 JUL 1971
CYCLONE 16
MAX SFC WND 130kts
MINIMUM SLP 915mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BONIN ISLANDS
MARCUS ISLAND
MARIANAS ISLANDS
CAROLINE
SOLOMON

The second super typhoon of the year showed her early signs of origin on 11 July as a circulation in the equatorial trough near the Truk Islands. After a five-day journey which brought the system into the Philippine Sea, Lucy became a tropical storm at a point 750 miles east of Manila.

While typhoon Jean was churning the waters of the South China Sea, aircraft reconnaissance measurements noted a steady reduction in Lucy's central pressure once she became a typhoon on the 17th. Thirty hours later a dropsonde reading in the eye indicated Lucy had bottomed out at 915 mb the morning of the 19th and that super typhoon level (130 kt) had been reached (Figure 5-21).

On a west-northwest track of 8-9 kt, the typhoon headed for the Luzon Straits. Navigating the straits, Lucy weakened slightly and passed 50 miles south of the Bataan Islands on the afternoon of the 20th. The Philippine Weather Bureau station at Basco registered a maximum sustained wind of 103 kt during Lucy's passage.

The circulation associated with the typhoon had grown to a diameter of 600 n mi by this time. Manila, located 300 miles to the south, came under strong southwesterly winds of 16 to 25 kt with gusts to 30 kt.

Lucy did not only buffet northern and central Luzon with destructive strong winds but dumped heavy rains causing severe flooding and landslides. Baguio city, during this period, reported a 24-hour rainfall total of 14.92 inches.

In Taiwan, highest winds reported were at Lanyu with 64 kt and gusts to 85 kt. Rainfall was considerably less in Taiwan with a maximum 24-hour amount of 4.97 inches measured at Taitung. Casualty reports in Taiwan listed two persons killed and five missing.

Lucy weakened to tropical storm force as she continued on her westerly course for the South China mainland (Figure 5-22). Striking the coast 15 miles northeast of Hong Kong, gusts of 80 kt were measured at Tate's Cairn in the colony while a minimum pressure of 977.9 mb was observed at the Royal Observatory. The storm continued to weaken as she moved inland and finally dissipated in the interior north of the Luichow peninsula.

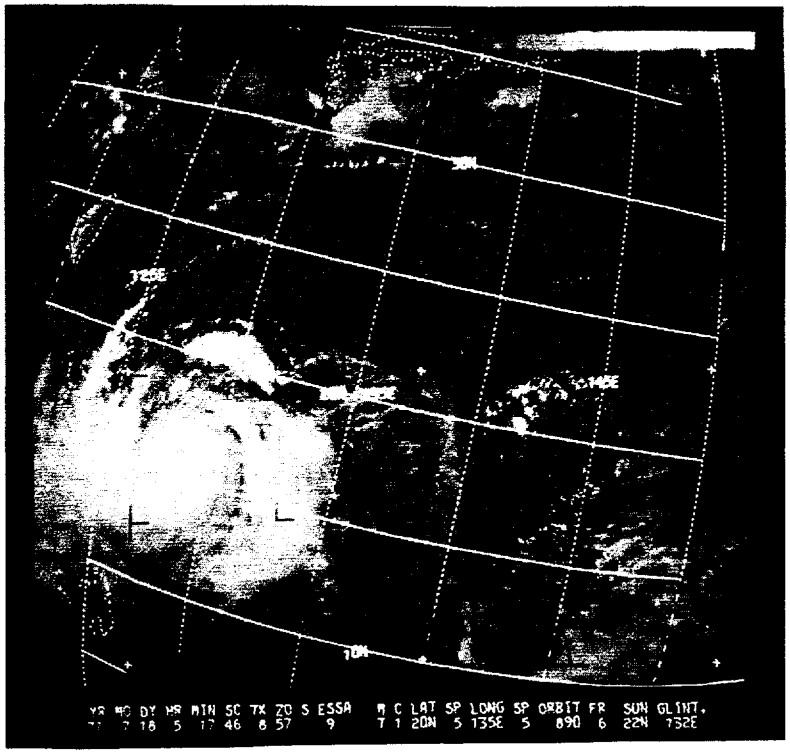


FIGURE 5-21. LUCY, LESS THAN A DAY FROM DEVELOPING TO A SUPER TYPHOON, AS SEEN BY ESSA-9 IN THE PHILIPPINE SEA ON 18 JULY.

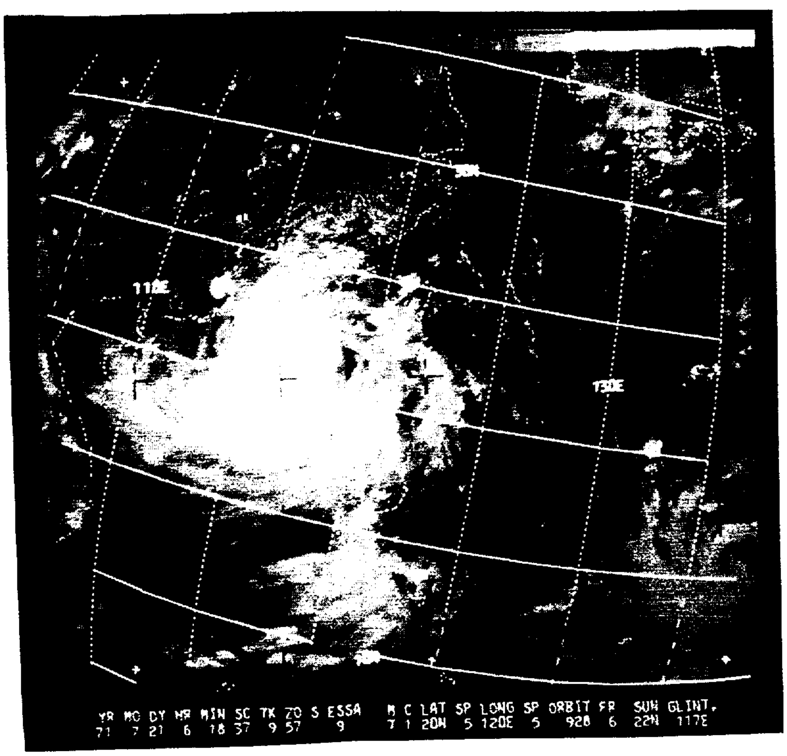


FIGURE 5-22. WEAKENED BY HER TRANSIT OF THE LUZON STRAITS, LUCY IS SEEN EAST OF HONG KONG ON 21 JULY. DISTURBANCE IN THE LOWER RIGHT PORTION OF THE ESSA-9 PHOTO IS TROPICAL STORM NADINE.

TYPHOON LUCY
EYE FIXES FOR CYCLONE NO. 16
16 JUL - 22 JUL 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	110509Z	7.0N 152.0E	SATELIT---	STG B										BANDS TO S	
2	120507Z	8.0N 148.0E	SATELIT---	STG B										LITTLE CHG	
3	130411Z	13.0N 145.0E	SATELIT---	STG B										POORLY ORGANIZED	
4	140509Z	13.0N 142.0E	SATELIT---	STG B										LITTLE CHG	
5	150412Z	13.0N 140.0E	SATELIT---	STG B										LITTLE CHG	
6	160511Z	15.0N 132.5E	SATELIT---	STG C+										STRONGER	
7	161108Z	15.0N 132.5E	54-P- 3- 7	700MB	75	----	972	2966	14/11	CIRC		30	--	WC FORMING W	
8	161545Z	15.1N 132.1E	54-P- 5- 7	700MB	50	----	980	2966	13/08	CIRC		35	--	WC OPEN F-N	
9	162236Z	15.1N 131.8E	54-P- 5---	700MB	55	55	981	2923	15/09	CIRC		65	--	CLSD WC	
10	170415Z	15.2N 131.4E	54-P- 1-19	700MB	50	60	975	2883	12/07	----	-----	--	--	NO WC-SFC WIND	
														CNTR 6NM DIA	
11	170610Z	15.5N 131.0E	SATELIT---	STG X	DIA	3 CAT	2.0							MORE INTENSE	
12	171000Z	15.5N 131.0E	54-P- 1- 9	700MB	70	65	963	2819	15/10	CIRC		40	--	WC POORLY DEF-700	
														CNTR 5NM SE	
13	171607Z	15.6N 130.1E	54-P- 5- 3	700MB	60	----	961	2752	14/06	CIRC		30	--	CLSD WC-STG FBS	
14	171810Z	15.9N 129.9E	54-P------	700MB	----	----	----	2707	15/--	----	-----	--	--		
15	172100Z	16.1N 129.0E	54-P- 5---	700MB	70	75	----	2707	15/08	CIRC		35	--	CLSD WC-STG FBS	
16	180428Z	16.7N 128.3E	VQ-R-10---	300M	----	75	----	----	--/25	CIRC		25	8	CLSD WC	15.8N 129.1E
17	180517Z	16.0N 128.0E	SATELIT---	STG X	DIA	4 CAT	4.0								
18	180632Z	16.4N 128.4E	VQ-R------	300M	----	----	----	----	--/--	----	-----	--	--	90KT SFC WIND OBS	17.5N 128.2E
														80NM N OF CNTR	
19	180910Z	16.6N 128.2E	VQ-P- 5- 3	700MB	120	115	929	2509	21/13	CIRC		23	8	CLSD WC	
20	181600Z	17.0N 127.4E	54-P- 5---	700MB	110	----	915	2356	23/15	CIRC		20	8	CLSD WC	
21	181745Z	17.2N 127.2E	54-P------	700MB	----	----	----	----	--/--	----	-----	--	--		
22	182200Z	17.8N 126.6E	54-P- 2---	700MB	95	110	918	2368	22/13	CIRC		20	7	CLSD WC-FIX OVR	
														VISUAL CIRC CNTR	
23	190600Z	18.3N 125.5E	54-P- 2- 2	700MB	110	115	912	2295	19/11	CIRC		30	10	CLSD WC-TOPS 30K	
24	190616Z	18.2N 125.2E	SATELIT---	STG X	DIA	5 CAT	4.0								
25	190737Z	18.4N 125.3E	54-P------	700MB	----	----	----	----	--/--	----	-----	--	--		
26	191000Z	18.6N 125.0E	54-P- 2- 2	700MB	105	110	920	2356	18/12	CIRC		30	10	CLSD WC-TOPS 30K	
27	191600Z	19.0N 124.4E	VQ-R- 5- 5	300M	----	----	----	----	--/--	CIRC		60	--	CLSD WC-PSBL CONC	18.0N 124.6E
														EYE+INDISTINCT	
28	192050Z	19.1N 123.4E	VQ-R- 5- 5	-----	----	----	----	----	--/--	CONC	-	60X11	4	CLSD OUTER WC	17.9N 123.8E
29	200100Z	19.5N 122.8E	54-P- 5---	700MB	95	120	935	2512	17/13	CONC	-	15X45	10	CLSD OUTER WC	
														TOPS INNER WC 15K	
30	200300Z	19.6N 122.7E	LND RDR---							----	-----	--	--	TAIWAN RDR	
31	200400Z	19.5N 122.3E	54-P- 2- 1	700MB	105	120	937	2530	17/11	CIRC		15	2	CLSD WC-OUTER WC	
														DISSIPATED	
32	200400Z	19.7N 122.5E	LND RDR---							----	-----	--	--	TAIWAN RDR	
33	200500Z	19.8N 122.3E	LND RDR---							----	-----	--	--	TAIWAN RDR	
34	200500Z	19.8N 122.6E	LND RDR---							----	-----	--	--	REP PHIL RDR	
35	200530Z	19.9N 122.3E	LND RDR---							----	-----	--	--	TAIWAN RDR	
36	200540Z	20.0N 122.0E	LND RDR---							----	-----	--	--	REP PHIL RDR	
37	200600Z	19.9N 122.2E	LND RDR---							----	-----	--	--	TAIWAN RDR	
38	200700Z	20.0N 122.0E	LND RDR---							----	-----	--	--	TAIWAN RDR	
39	200700Z	19.9N 122.2E	54-P- 2---	700MB	105	110	937	2505	--/--	ELIP	NE-SW	45X30	10	INNER WC WEAKENED	
40	200710Z	20.0N 122.0E	SATELIT---	STG X	DIA	4 CAT	4.0							EYE VISIBLE	
41	200900Z	20.3N 121.8E	LND RDR---							----	-----	--	--	TAIWAN RDR	
42	200900Z	20.1N 121.8E	54-P- 5---	700MB	95	110	939	2566	--/--	CIRC		40	10	INNER WC GONE-RDR	
														PRES CHG RAPIDLY	

TYPHOON LUCY
EYE FIXES FOR CYCLONE NO. 16
16 JUL - 22 JUL 71

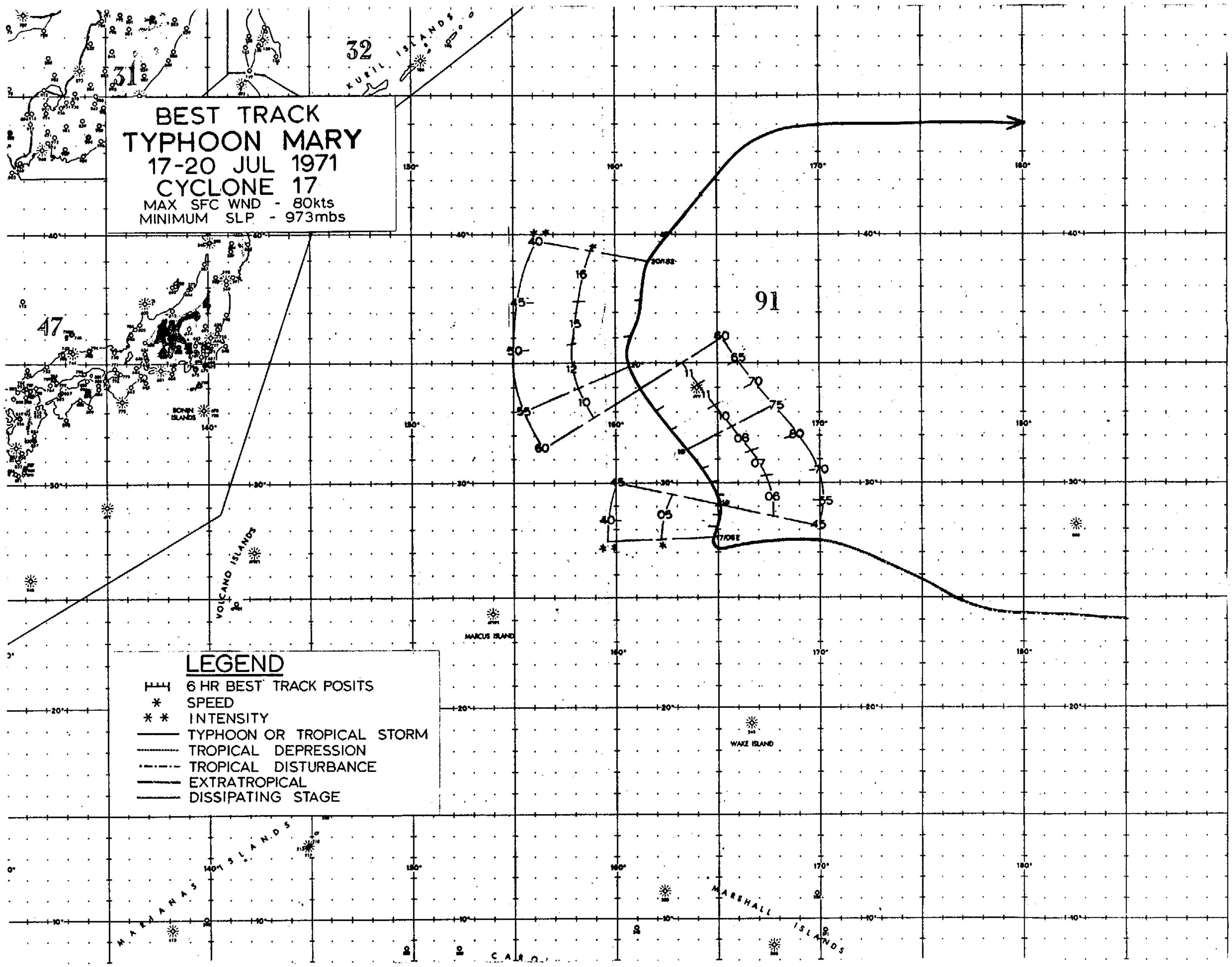
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
43	201100Z	20.3N 121.6E	LND RDR---							----	-----	--	--	TAIWAN RDR	
44	201200Z	20.5N 121.1E	LND RDR---							----	-----	--	--	TAIWAN RDR	
45	201300Z	20.5N 120.8E	LND RDR---							----	-----	--	--	TAIWAN RDR	
46	201538Z	20.6N 120.0E	54-P- 2---	500MB	75	----	952	----	+3/-5	CIRC		20	10	WC OPEN N	
47	201652Z	20.8N 120.0E	LND RDR---							----	-----	--	--	TAIWAN RDR	
48	201800Z	20.6N 119.8E	LND RDR---							----	-----	--	--	TAIWAN RDR	
49	201900Z	20.7N 119.6E	LND RDR---							----	-----	--	--	TAIWAN RDR	
50	201900Z	20.7N 119.5E	54-P- 2---	500MB	90	----	945	----	+3/-6	CIRC		25	10	POOR RDR PRES	
51	202000Z	20.9N 119.5E	LND RDR---							----	-----	--	--	TAIWAN RDR	
52	202000Z	20.5N 119.3E	LND RDR---							----	-----	--	--	REP PHIL RDR	
53	202100Z	20.9N 119.3E	LND RDR---							----	-----	--	--	TAIWAN RDR	
54	202115Z	20.9N 119.1E	54-P- 2---	500MB	100	----	953	----	+2/ 0	CIRC		30	3	WC CLSD	
55	202200Z	20.9N 119.0E	LND RDR---							----	-----	--	--	TAIWAN RDR	
56	210000Z	20.8N 118.6E	LND RDR---							----	-----	--	--	TAIWAN RDR	
57	210100Z	20.9N 118.4E	LND RDR---							----	-----	--	--	TAIWAN RDR	
58	210200Z	21.0N 118.2E	LND RDR---							----	-----	--	--	TAIWAN RDR	
59	210300Z	21.2N 118.2E	LND RDR---							----	-----	--	--	TAIWAN RDR	
60	210400Z	21.3N 118.0E	LND RDR---							----	-----	--	--	TAIWAN RDR	
61	210500Z	21.4N 117.7E	LND RDR---							----	-----	--	--	TAIWAN RDR	
62	210500Z	21.3N 117.9E	LND RDR---							----	-----	--	--	TAIWAN RDR	
63	210600Z	21.1N 117.6E	LND RDR---							----	-----	--	--	TAIWAN RDR	
64	210618Z	21.0N 117.0E	SATELIT---	STG X	DIA	4	CAT 3.5							EYE NOT VISIBLE	
65	210618Z	21.0N 117.8E	LND RDR---							----	-----	--	--	TAIWAN RDR	
66	210630Z	21.2N 117.4E	54-P-30---	500MB	----	----	----	----	--/--	CIRC		25	8	RDR PRES POOR	20.7N 117.5E
67	210700Z	21.1N 116.8E	LND RDR---							----	-----	--	--	POOR FIX-VHHH	22.3N 114.2E
68	211200Z	21.2N 116.6E	LND RDR---							----	-----	--	--	POOR FIX-VHHH	22.3N 114.2E
69	211500Z	21.5N 116.4E	LND RDR---							----	-----	--	--	POOR FIX-VHHH	22.3N 114.2E
70	211800Z	21.8N 115.9E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
71	212100Z	22.0N 115.6E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
72	212200Z	22.0N 115.4E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
73	212300Z	22.1N 115.3E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
74	220000Z	22.2N 115.2E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
75	220100Z	22.2N 114.9E	LND RDR---							----	-----	--	--	FAIR FIX	
76	220200Z	22.4N 114.8E	LND RDR---							----	-----	--	--	FAIR FIX-VHHH	22.3N 114.2E
77	220300Z	22.6N 114.7E	LND RDR---							----	-----	--	--	POOR FIX-VHHH	22.3N 114.2E
78	220400Z	22.6N 114.4E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E
79	220500Z	22.7N 114.2E	LND RDR---							----	-----	--	--	GOOD FIX-VHHH	22.3N 114.2E

TYPHOON LUCY

0600Z 16 JUL TO 1200Z 22 JUL

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
160600Z	15.0N 133.2E	45	15.2N 133.3E	30	13	-15	16.0N 129.5E	50	109	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161200Z	15.1N 132.5E	50	15.1N 132.4E	60	6	10	16.1N 128.1E	100	151	30	18.2N 123.5E	120	264	5	21.2N 119.0E	100	356	-20
161800Z	15.1N 132.0E	55	15.1N 131.8E	60	12	5	16.2N 128.0E	100	115	25	18.1N 123.8E	120	192	-5	--.- ---.-	--	--	--
170000Z	15.1N 131.7E	60	15.1N 131.7E	65	0	5	15.6N 129.7E	80	29	-5	16.7N 126.7E	95	72	-30	18.6N 123.0E	115	48	5
170600Z	15.2N 131.2E	65	15.3N 130.8E	70	24	5	16.4N 127.2E	95	80	-5	18.4N 123.2E	115	131	-15	--.- ---.-	--	--	--
171200Z	15.3N 130.6E	70	15.5N 130.8E	70	17	0	16.2N 128.8E	85	63	-30	17.5N 125.8E	95	91	-25	19.6N 122.3E	105	87	5
171800Z	15.6N 129.9E	75	15.7N 129.9E	80	6	5	17.2N 126.6E	100	31	-25	18.8N 123.4E	110	21	-5	--.- ---.-	--	--	--
180000Z	15.9N 129.3E	85	16.0N 129.2E	90	8	5	17.4N 126.0E	110	26	-15	19.1N 123.1E	120	21	10	21.0N 120.3E	115	100	25
180600Z	16.4N 128.6E	100	16.5N 128.3E	100	18	0	17.9N 125.0E	115	37	-15	19.7N 122.2E	120	6	15	--.- ---.-	--	--	--
181200Z	16.8N 127.9E	115	16.8N 127.8E	115	6	0	18.7N 124.7E	130	6	10	20.8N 121.6E	120	41	20	22.5N 119.2E	110	156	35
181800Z	17.4N 127.1E	125	17.2N 127.2E	120	13	-5	18.9N 124.4E	130	40	15	20.6N 121.8E	120	123	25	--.- ---.-	--	--	--
190000Z	17.8N 126.2E	125	17.9N 126.4E	130	13	5	19.7N 123.4E	140	33	30	21.5N 120.6E	125	121	35	23.4N 118.0E	100	178	40
190600Z	18.3N 125.5E	130	18.3N 125.5E	130	0	0	20.0N 122.5E	140	21	35	21.9N 120.0E	125	138	40	--.- ---.-	--	--	--
191200Z	18.6N 124.7E	120	18.7N 124.7E	125	6	5	20.7N 121.8E	115	48	15	22.6N 119.1E	100	153	25	24.7N 116.5E	60	246	25
191800Z	19.0N 123.7E	115	19.1N 124.1E	125	23	10	20.9N 121.4E	115	101	20	22.9N 118.7E	100	173	30	--.- ---.-	--	--	--
200000Z	19.4N 122.9E	110	19.6N 123.0E	120	13	10	21.3N 119.7E	100	69	10	23.0N 116.3E	90	83	30	--.- ---.-	--	--	--
200600Z	19.8N 122.2E	105	19.7N 122.0E	115	13	10	21.0N 118.5E	100	53	15	22.2N 114.9E	95	65	50	--.- ---.-	--	--	--
201200Z	20.4N 121.0E	100	20.2N 121.4E	110	25	10	21.6N 117.8E	100	67	25	22.8N 114.2E	85	94	50	--.- ---.-	--	--	--
201800Z	20.7N 119.6E	95	20.8N 119.8E	110	13	15	22.2N 115.8E	100	24	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210000Z	21.0N 118.5E	90	21.0N 118.6E	105	6	15	22.2N 114.8E	90	13	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210600Z	21.3N 117.6E	85	21.3N 117.5E	100	6	15	22.5N 113.4E	85	23	40	--.- ---.-	--	--	--	--.- ---.-	--	--	--
211200Z	21.5N 116.6E	75	21.6N 116.6E	95	6	20	22.7N 112.3E	40	13	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
211800Z	21.8N 115.8E	70	21.5N 115.9E	95	19	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
220000Z	22.3N 115.0E	60	22.2N 115.0E	90	6	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
220600Z	22.6N 113.8E	45	22.7N 114.0E	65	13	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
221200Z	22.8N 112.5E	35	22.9N 112.8E	35	18	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	12NM	52NM	105NM	167NM	12NM	52NM	105NM	167NM
AVERAGE RIGHT ANGLE ERROR	7NM	20NM	44NM	69NM	7NM	20NM	44NM	69NM
AVERAGE MAGNITUDE OF WIND ERROR	9KTS	20KTS	24KTS	22KTS	9KTS	20KTS	24KTS	22KTS
AVERAGE BIAS OF WIND ERROR	8KTS	10KTS	15KTS	16KTS	8KTS	10KTS	15KTS	16KTS
NUMBER OF FORECASTS	26	22	17	7	26	22	17	7



BEST TRACK
TYPHOON MARY
17-20 JUL 1971
CYCLONE 17
MAX SFC WND - 80kts
MINIMUM SLP - 973mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
KURIL ISLANDS
VOLCANO ISLANDS
MARIANAS ISLANDS
MARSHALL ISLANDS
MARCUS ISLAND
WAKE ISLAND
BONIN ISLANDS
31
32
47
91

MARY

Mary developed from a circulation induced from an upper tropospheric low in the mid-Pacific trough. Tracing back to a position south of Midway Island on 11 July, the system drifted westward to a location halfway between Wake and Ocean Station Victor before aircraft reconnaissance identified it as a tropical storm on the 17th.

With Jean in the South China Sea and Lucy in the Philippine Sea, Mary increased the simultaneous storm count in the western Pacific to three.

Mary began to take a northward course later on the 17th as she rounded the southeastern periphery of a high cell situated north of the western Hawaiian Islands. The small size of Mary, the uncertainty of forward acceleration, coupled with the storm's position being outside the FWC APT coverage area on the 18th shed uncertainty as to her location. However, a valuable and timely piece of information was relayed to Guam by NESS at Suitland, based on the position of Mary on their geostationary ATS-1 satellite picture. With this information a reconnaissance aircraft was vectored toward Mary and found that she had achieved typhoon strength (Figure 5-23 and 5-24).

Remaining at minimal typhoon strength for 24 hours, Mary passed 150 n mi west of Ocean Station Victor on the 20th and diminished to storm status as she headed northward. By morning of the 21st Mary was beyond the range of reconnaissance aircraft as she accelerated to a rate of 16 kt. By that afternoon satellite data indicated that cooler air had entered the storm as she headed northeast and was becoming extratropical.

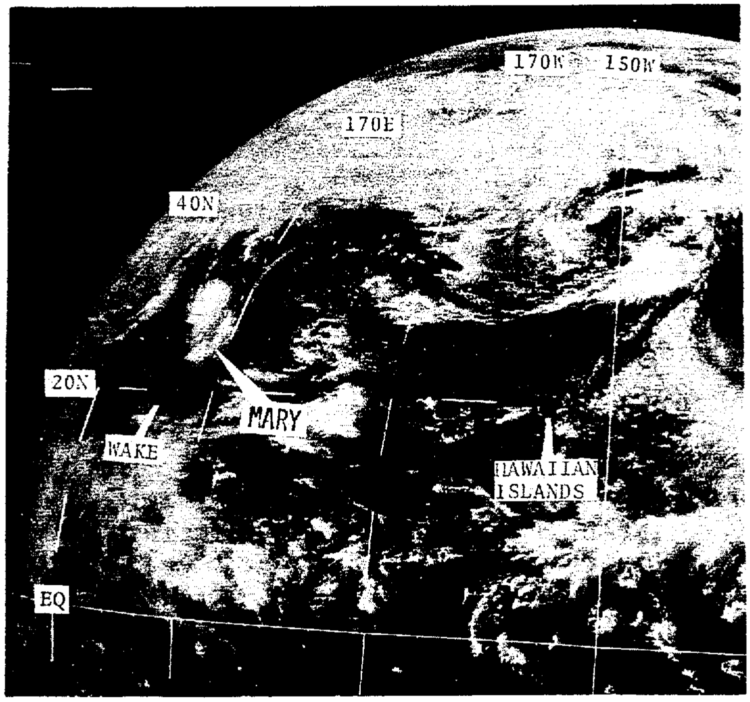


FIGURE 5-23. ATS-1 GEOSTATIONARY SATELLITE PRESENTATION OF MARY AS A NEWLY-FORMED TYPHOON NORTH OF WAKE ISLAND.

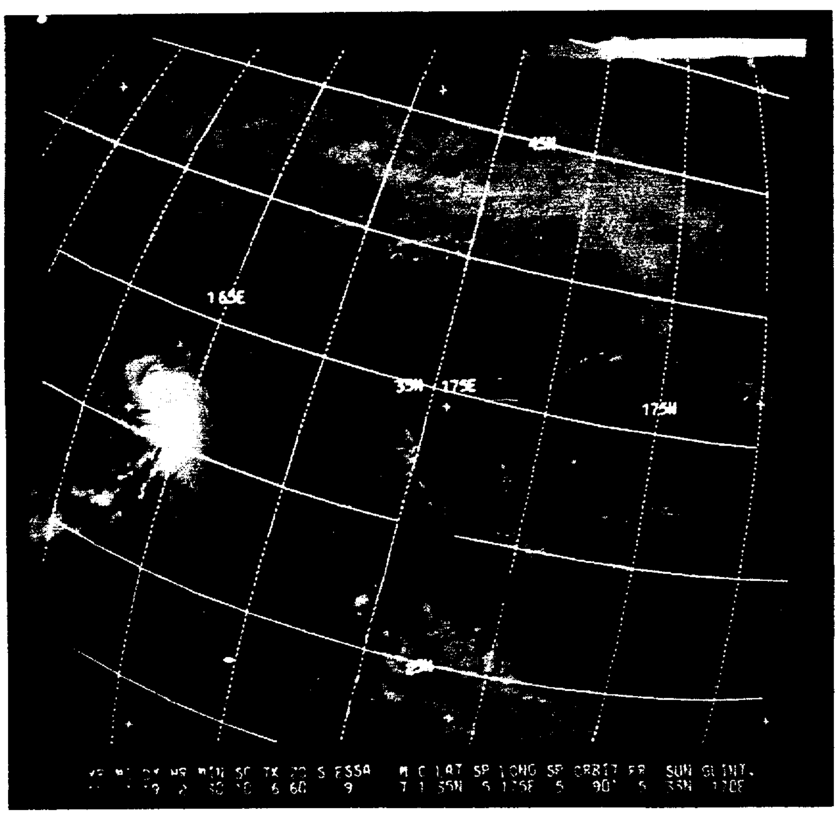


FIGURE 5-24. TYPHOON MARY ON 19 JULY AS SIGHTED BY ESSA-9 SOUTH OF OCEAN STATION VICTOR.

TYPHOON MARY
EYE FIXES FOR CYCLONE NO. 17
17 JUL - 20 JUL 71

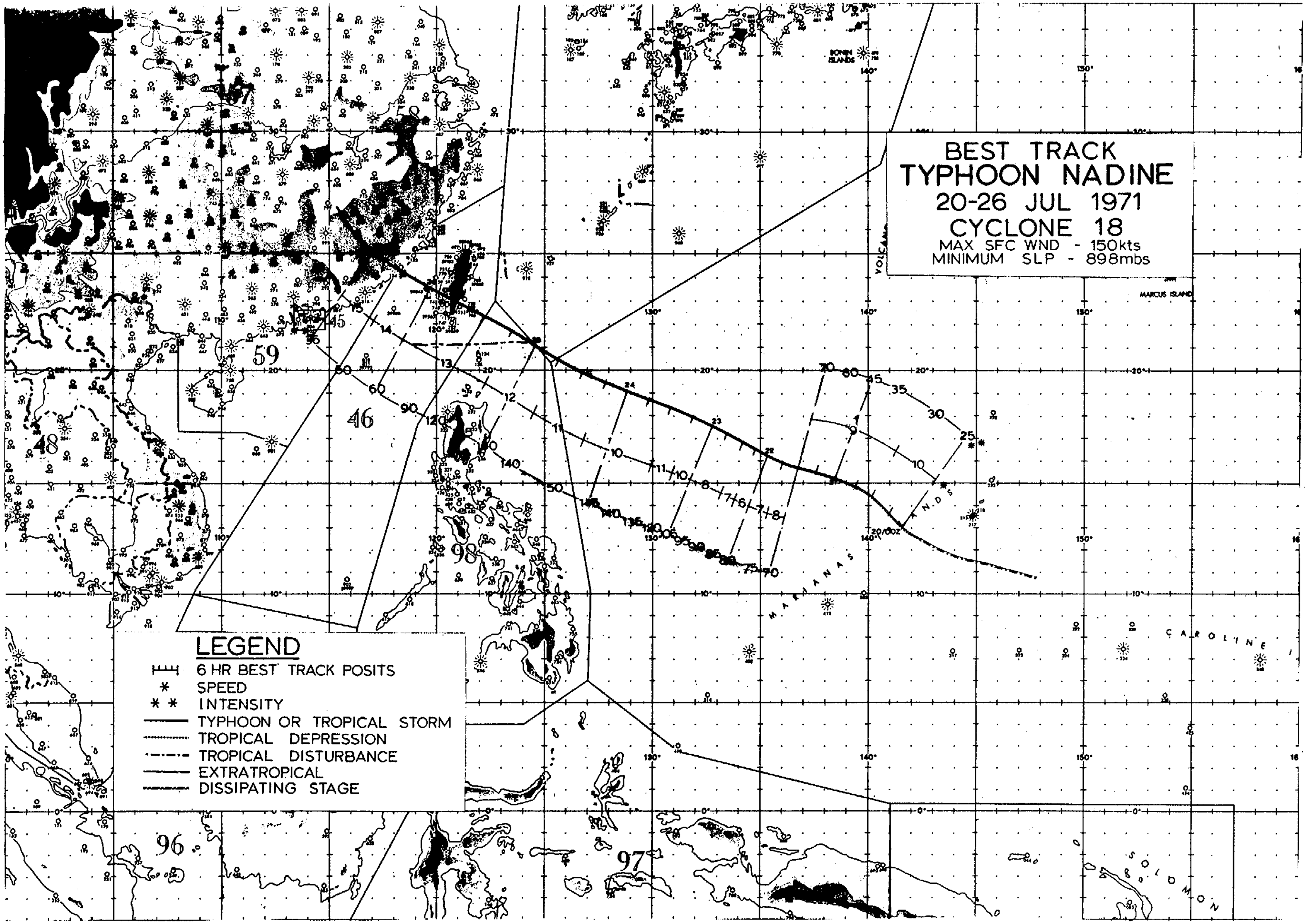
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	130220Z	24.0N 179.5E	SATELIT---	STG C											
2	160320Z	27.5N 169.5E	SATELIT---	STG C											
3	170030Z	27.2N 165.0E	54-P-25- 3	700MB	35	45	998	3109	11/08	----	-----	--	--		
4	170227Z	27.5N 165.0E	SATELIT---	STG C											
5	172335Z	29.3N 165.3E	54-P- 6---	700MB	40	35	1000	3082	14/12	ELIP	N-S	30X20	--		
6	180200Z	29.3N 165.1E	54-P-10---	700MB	40	45	994	2988	16/13	ELIP	N-S	30X20	--		
7	180326Z	29.5N 165.0E	SATELIT---	STG C											
8	181120Z	30.0N 164.9E	VQ-P-15---	700MB	60	----	978	2886	16/10	CIRC		15	--		
9	181605Z	30.5N 164.2E	54-P- 3- 2	700MB	70	----	973	2789	14/09	CIRC		17	7		
10	182200Z	31.1N 163.7E	54-P- 7---	700MB	85	70	976	2871	14/11	CIRC		15	--		
11	190000Z	31.4N 163.7E	54-P------	700MB	----	----	----	2865	--/--	----	-----	--	--		
12	190205Z	31.9N 163.2E	----------	-----	----	----	----	----	--/--	----	-----	--	--		
13	190230Z	31.5N 163.0E	SATELIT---	STG X	DIA	2	CAT 3.0								
14	190400Z	31.6N 163.3E	54-P- 8---	700MB	65	----	976	2868	14/13	CIRC		15	--		
15	191021Z	32.9N 162.3E	VQ-R-10---	300M	----	----	----	----	--/--	CIRC		20	5		32.0N 162.2E
16	191531Z	33.6N 161.4E	VQ-P- 6---	700MB	46	----	979	2966	17/11	CIRC		20	--		
17	192142Z	34.6N 160.9E	54-P-10- 2	700MB	45	45	975	2923	13/10	CIRC		20	--		
18	200300Z	35.5N 160.7E	54-P-10- 2	500MB	57	40	967	----	-1/-4	CIRC		20	--		
19	200328Z	36.0N 160.0E	SATELIT---	STG C											
20	201000Z	36.9N 161.3E	54-P- 8---	500MB	40	----	987	----	-1/-1	----	-----	--	--		
21	201410Z	38.3N 161.3E	54-P- 5---	500MB	40	----	988	----	-2/-2	----	-----	--	--		
22	210235Z	41.0N 164.0E	SATELIT---	STG C											

TYPHOON MARY

0600Z 17 JUL TO 1800Z 20 JUL

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
170600Z	27.6N 164.8E	40	28.3N 163.6E	45	76	5	30.9N 158.7E	55	334	0	33.7N 157.1E	55	299	-15	--.- ---.-	--	--	--
171200Z	28.1N 165.0E	40	28.4N 162.2E	45	148	5	31.4N 158.0E	55	353	-15	34.5N 157.4E	55	245	-10	--.- ---.-	--	--	--
171800Z	28.6N 165.1E	40	28.7N 161.5E	45	189	5	31.4N 158.0E	55	320	-25	34.9N 157.5E	55	192	-5	--.- ---.-	--	--	--
180000Z	29.0N 165.1E	45	29.3N 165.2E	45	19	0	31.1N 162.2E	50	74	-25	33.5N 160.8E	45	84	-10	--.- ---.-	--	--	--
180600Z	29.6N 165.0E	55	29.7N 164.5E	45	27	-10	32.3N 161.3E	50	76	-20	34.8N 161.3E	45	81	-5	--.- ---.-	--	--	--
181200Z	30.1N 164.7E	70	30.1N 164.8E	50	5	-20	32.3N 163.2E	50	73	-15	35.0N 162.4E	40	158	-5	--.- ---.-	--	--	--
181800Z	30.7N 164.2E	80	30.7N 163.9E	70	15	-10	33.1N 161.9E	65	59	5	36.0N 162.9E	55	192	15	--.- ---.-	--	--	--
190000Z	31.4N 163.6E	75	31.2N 163.5E	70	13	-5	33.8N 162.3E	60	99	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
190600Z	32.2N 162.8E	70	31.8N 163.2E	65	31	-5	34.5N 162.3E	55	120	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
191200Z	33.0N 162.0E	65	33.0N 162.0E	55	0	-10	38.0N 166.3E	25	238	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
191800Z	33.9N 161.2E	60	34.1N 161.3E	50	13	-10	38.5N 167.1E	20	249	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
200000Z	34.9N 160.8E	55	35.0N 160.7E	50	8	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
200600Z	36.1N 160.8E	50	36.1N 160.8E	40	0	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201200Z	37.5N 161.3E	45	36.3N 161.5E	35	72	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201800Z	39.1N 161.8E	40	39.3N 162.1E	35	18	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	42NM	181NM	179NM	0NM	42NM	181NM	179NM	0NM
AVERAGE RIGHT ANGLE ERROR	35NM	126NM	108NM	0NM	35NM	126NM	108NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	14KTS	9KTS	0KTS	8KTS	14KTS	9KTS	0KTS
AVERAGE BIAS OF WIND ERROR	-6KTS	-11KTS	-5KTS	0KTS	-6KTS	-11KTS	-5KTS	0KTS
NUMBER OF FORECASTS	15	11	7	0	15	11	7	0


BEST TRACK
TYPHOON NADINE
20-26 JUL 1971
CYCLONE 18
MAX SFC WND - 150kts
MINIMUM SLP - 898mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BONIN ISLANDS
MARCUS ISLAND
MARIANAS
CAROLINE
SOLOMON

NADINE

As typhoon Lucy was reaching super typhoon strength in the Philippine Sea, another circulation destined to be Nadine, formed southeast of Guam on July 16th.

During her formative stages the pre-Nadine system dumped 6.05 inches of rain on Guam over a three-day period as she passed into the Philippine Sea causing [illegible] flooding on the island. Evidence that Nadine was on her way to intensification was provided by the AMERICAN CHARGER which reported northerly winds at 47 kt about 75 n mi due west of the center at 2200 GMT July 20th. Nadine took a track slightly northward of Lucy's as the ridge began to build across to the north dictating a west-northwest course of 8-10 kt.

Quickly reaching typhoon force (Figures 5-25 and 5-26), Nadine began to grow both in size and strength. The central pressure began to plummet rapidly and gale force winds began to spread. At her height the minimum pressure reported by reconnaissance aircraft was 898 mb some 300 n mi northeast of Luzon on the 24th. Maximum winds at this time of 150 kt were packed around Nadine's 20 n mi diameter eye. 100-kt winds spread some 100 n mi from the center while gale force winds encompassed the western Philippine Sea in excess of 300 n mi from the typhoon's eye.

As Nadine approached Taiwan, gales were felt as far south as Manila which reported gusts to 33 kt. The Philippine Weather Bureau station on Basco in the Luzon Straits measured wind gusts of 127 kt (probably due to channeling in the straits) as Nadine's center passed 100 n mi to the northwest.

The poor weather and low ceilings over Luzon caused by Nadine may have contributed to the crash of a Pan American cargo aircraft. Bound from Guam to Manila, the jet crashed into a mountain side 17 miles northeast of Manila on July 25th with the loss of four crew members.

Nadine's eye landed on the southeastern coast of Taiwan between Hsinkong and Taitung in the early morning of July 26th. The typhoon brought torrential rain over southeastern Taiwan with 12.07 inches recorded at Hengehan during her passage. Lanyu recorded maximum winds of 95 kt and gusts to 99 kt. The toll in Taiwan due to the typhoon amounted to 28 killed with an additional 25 missing. Over 1,250

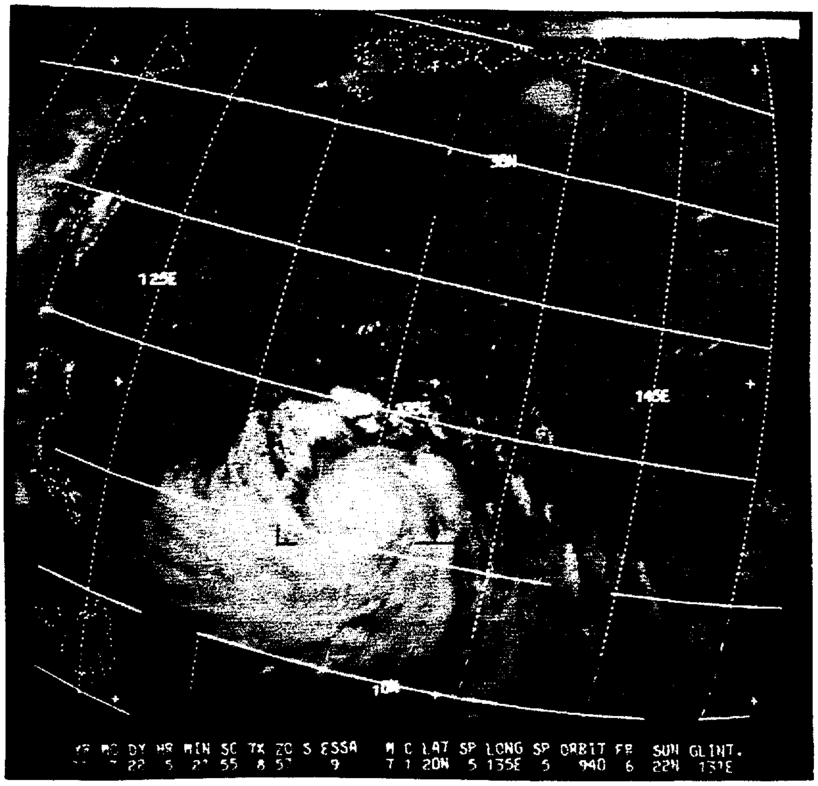


FIGURE 5-25. NADINE AS A RECENTLY DEVELOPED TYPHOON IN THE PHILIPPINE SEA ON 22 JULY.

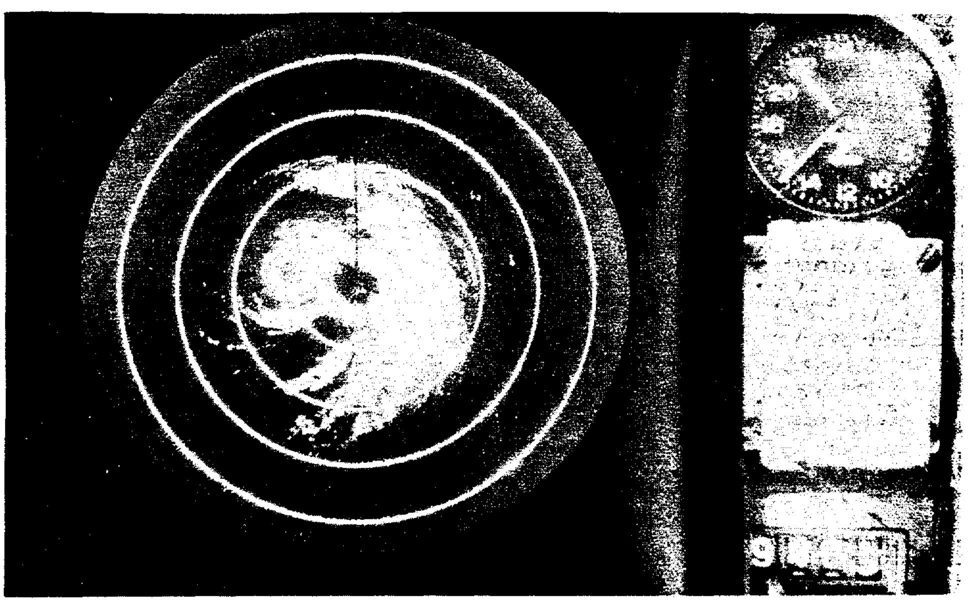


FIGURE 5-26. APS-20 RADARSCOPE PICTURE OF NADINE TAKEN FROM NAVY RECONNAISSANCE AIRCRAFT (VQ-1) AT 2137 GMT 23 JULY (RANGE MARKS ARE AT 50 N MI INTERVALS).

homes were totally destroyed and some 2,180 dwellings were badly damaged. In addition, the Liberian tanker WARWICK TRADER drug anchor and became lodged in the soft sand off the southwestern coast of Taiwan.

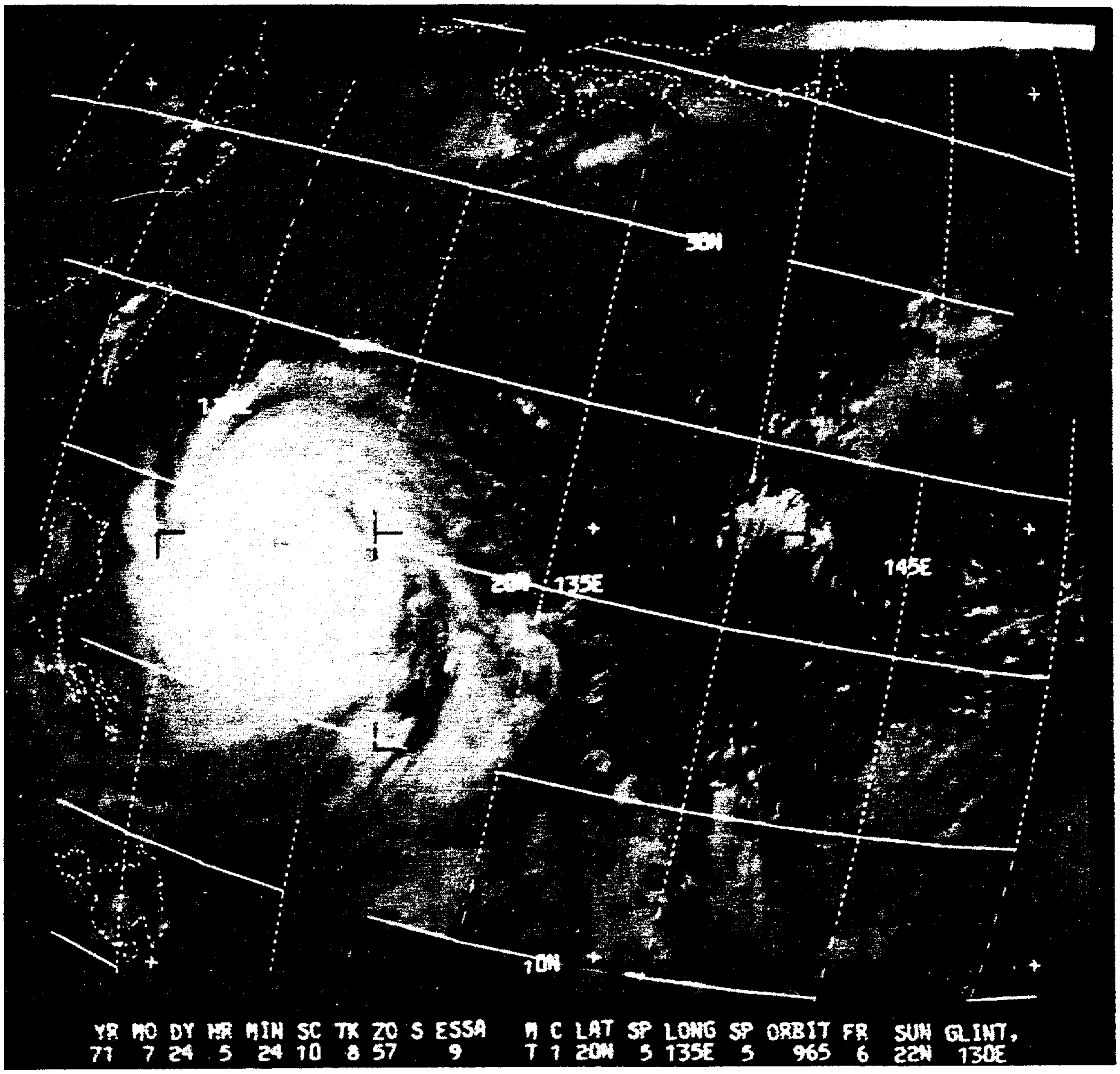


FIGURE 5-27. ESSA-9 VIEW OF NADINE AT HER PEAK AS A SUPER TYPHOON ON 24 JULY.

TYPHOON NADINE
EYE FIXES FOR CYCLONE NO. 18
20 JUL - 26 JUL 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIENTATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	190421Z	12.0N 145.0E	SATELIT---	STG B										FIRST BLTN	
2	192315Z	12.9N 141.0E	54-P------	700MB	----	20	----	----	--/--	----	-----	--	--	BROAD CIRCULATION	
3	200300Z	13.3N 141.3E	54-P- 2-10	700MB	35	35	1006	3103	10/10	----	-----	--	--	NEG RDR PRES	
4	200515Z	14.0N 140.0E	SATELIT---	STG C										MORE INTENSE	
5	200935Z	14.5N 140.7E	54-P- 2-10	700MB	15	----	1001	3057	10/10	----	-----	--	--	POORLY ORGANIZED	
6	201600Z	14.6N 139.8E	54-P- 5-10	700MB	30	----	1003	3048	09/09	----	-----	--	--	WC FORMING W	
7	202200Z	15.1N 138.8E	54-P- 5- 5	700MB	46	30	1000	3072	12/09	----	-----	--	--	700 CNTR 10NM W	
8	210340Z	15.6N 137.8E	VQ-P- 5---	300M	----	70	991	----	27/24	CIRC		45	--	NO WC	
9	210423Z	16.0N 137.0E	SATELIT---	STG C+										MORE INTENSE	
10	211006Z	15.6N 137.0E	54-P- 6- 4	700MB	70	----	983	2905	11/09	CIRC		35	--	WC OPEN S-W	
11	211555Z	15.9N 136.1E	VQ-P- 5---	700MB	60	----	977	2950	17/11	ELIP	E-W	44X34	--	WC OPEN N	
12	212120Z	16.0N 135.7E	54-P- 5---	700MB	65	75	977	2844	12/07	ELIP	SE-NW	40	--	NO WC	
13	220322Z	16.4N 135.0E	54-P- 5---	700MB	70	65	----	2810	13/09	ELIP	SE-NW	30X20	--	WC FORMING E	
14	220522Z	16.5N 134.5E	SATELIT---	STG X	DIA	2	CAT 3.0							EYE VISIBLE	
15	221543Z	17.1N 133.7E	VQ-P-10---	700MB	----	----	953	2743	20/11	CIRC		23	--	CLSD WC-HVY FBS	
16	222150Z	17.5N 133.1E	54-P- 5- 5	700MB	90	100	950	2652	19/14	CIRC		30	--	WC OPEN W 700 MB CNTR 4 NM S	
17	230310Z	17.7N 132.4E	54-P- 5- 5	700MB	93	120	939	2557	19/15	CIRC		30	--	CLSD WC	
18	230617Z	19.0N 132.0E	SATELIT---	STG X	DIA	3	CAT 4.0							EYE VISIBLE	
19	231000Z	18.3N 131.1E	54-P- 5- 2	700MB	115	----	920	2387	23/16	CIRC		20	--	CLSD WC	
20	231132Z	18.4N 130.8E	54-P------	700MB	----	----	----	2356	25/10	----	-----	--	--		
21	231513Z	18.5N 130.3E	54-P- 5- 2	700MB	125	----	907	2289	25/16	CIRC		25	--	CLSD WC-STG FBS	
22	232202Z	19.1N 129.2E	VQ-P- 5---	270M	145	140	903	----	28/25	CIRC		20	9	CLSD WC	
23	240301Z	19.3N 128.2E	VQ-R- 3- 7	-----	122	120	----	----	--/--	CIRC		20	9	CLSD WC	20.0N 127.7E
24	240525Z	19.5N 127.5E	SATELIT---	STG X	DIA	4	CAT 4.0							CIRC EYE VSBL	
25	241029Z	19.9N 127.1E	54-P- 3- 3	700MB	100	----	898	2185	21/12	CIRC		20	--	CLSD WC	
26	241200Z	20.0N 126.7E	54-P------	700MB	----	----	906	2210	--/--	----	-----	--	--		
27	241500Z	20.2N 126.2E	54-P- 3- 3	700MB	100	----	904	2243	19/13	CIRC		20	--	CLSD WC	
28	242215Z	20.9N 124.9E	VQ-P- 7- 3	700MB	80	100	919	2240	20/16	ELIP	N-S	35X25	10	CLSD WC-STG FBS	
29	250100Z	21.1N 124.3E	VQ-P- 1- 4	700MB	75	85	923	2243	21/16	ELIP	SE-NW	25X20	8	CLSD WC-TOPS 25K	
30	250300Z	21.4N 124.2E	LND RDR---							----	-----	--	--		
31	250345Z	21.5N 124.0E	VQ-P- 1- 4	700MB	80	100	925	2246	21/16	ELIP	NE-SW	40X25	10	WC OPEN NW	
32	250400Z	21.6N 123.6E	LND RDR---							----	-----	--	--		
33	250500Z	21.8N 123.7E	LND RDR---							----	-----	--	--		
34	250600Z	21.8N 123.4E	LND RDR---							----	-----	--	--		
35	250623Z	22.0N 123.0E	SATELIT---	STG X	DIA	4	CAT 4.0							EYE SMALLER	
36	250659Z	22.2N 123.5E	54-P- 2- 3	700MB	89	----	927	2454	21/14	ELIP	N-S	25X20	7	CLSD WC	
37	250700Z	22.0N 123.3E	LND RDR---							----	-----	--	--		
38	250800Z	22.2N 123.1E	LND RDR---							----	-----	--	--		
39	250900Z	22.3N 123.0E	LND RDR---							----	-----	--	--		
40	250954Z	22.3N 122.7E	VQ-P- 2- 3	330M	100	105	930	----	26/24	ELIP	N-S	34X22	7	WC OPEN NW	
41	251000Z	22.5N 122.7E	LND RDR---							----	-----	--	--		
42	251100Z	22.4N 122.4E	LND RDR---							----	-----	--	--		
43	251200Z	22.5N 122.4E	LND RDR---							----	-----	--	--		
44	251213Z	22.4N 122.2E	VQ-R- 2- 8	-----	50	----	----	----	--/--	ELIP	N-S	25X22	6	WC OPEN SE	21.8N 121.4E
45	251300Z	22.4N 122.1E	LND RDR---							----	-----	--	--		
46	251400Z	22.5N 121.9E	LND RDR---							----	-----	--	--		
47	251500Z	22.6N 121.7E	LND RDR---							----	-----	--	--		
48	251600Z	22.5N 121.6E	LND RDR---							----	-----	--	--		
49	251630Z	22.7N 121.5E	54-P- 5- 8	400MB	30	----	938	----	-6/-7	CIRC		20	--	RAGGED WC	

TYPHOON NADINE
EYE FIXES FOR CYCLONE NO. 18
20 JUL - 26 JUL 71

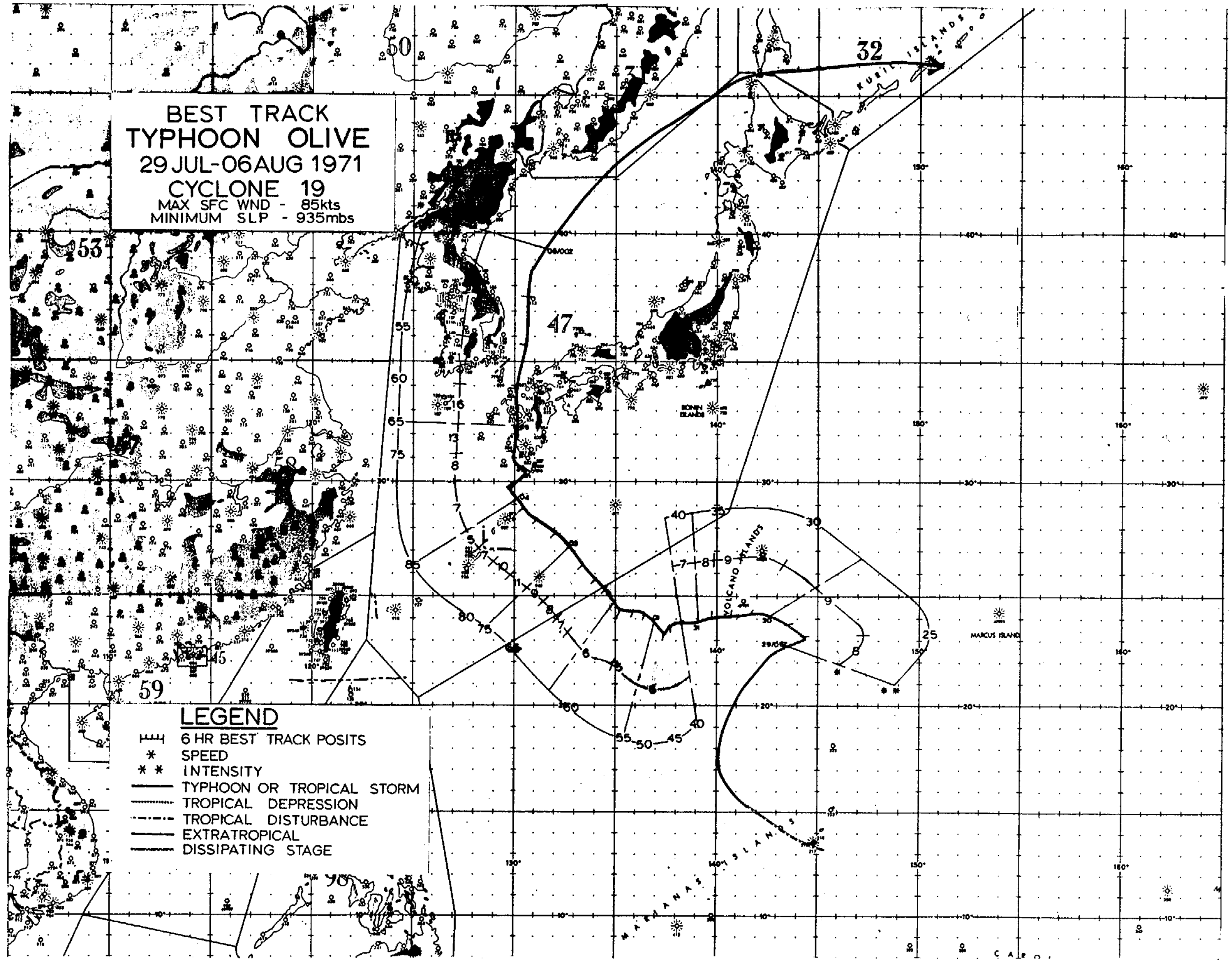
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
50	251700Z	22.8N 121.4E	LND RDR---							----	-----	--	--		
51	251800Z	22.9N 121.2E	LND RDR---							----	-----	--	--		
52	251900Z	22.9N 121.1E	LND RDR---							----	-----	--	--		
53	251900Z	22.9N 121.1E	54-P- 3- 7	400MB	60	----	----	----	-7/-9	CIRC		30	--	POORLY DEFINED	
54	252100Z	22.9N 120.5E	----------	-----	----	----	----	----	--/--	----	-----	--	--	EST SFC POSIT	
55	252300Z	23.4N 119.8E	LND RDR---							----	-----	--	--		
56	260000Z	23.6N 119.7E	LND RDR---							----	-----	--	--		
57	260100Z	23.8N 119.4E	LND RDR---							----	-----	--	--		
58	260200Z	24.0N 119.2E	LND RDR---							----	-----	--	--		
59	260500Z	24.2N 118.8E	LND RDR---							----	-----	--	--		

TYPHOON NADINE

0000Z 20 JUL TO 1200Z 26 JUL

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORFCAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
200000Z	13.0N 141.7E	25	12.9N 141.5E	25	13	0	13.4N 139.6E	50	125	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
200600Z	13.7N 140.9E	30	13.3N 141.1E	30	27	0	14.3N 139.2E	55	113	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201200Z	14.3N 140.2E	30	14.9N 140.4E	30	38	0	17.2N 137.6E	60	101	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201800Z	14.8N 139.4E	35	15.1N 139.7E	30	25	-5	17.0N 136.8E	65	80	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210000Z	15.2N 138.5E	45	15.3N 138.5E	30	6	-15	16.5N 134.7E	70	39	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210600Z	15.4N 137.6E	60	15.6N 137.4E	65	17	5	17.0N 133.3E	95	91	10	18.4N 129.4E	125	144	5	--.- ---.-	--	--	--
211200Z	15.7N 136.8E	70	15.7N 136.7E	75	6	5	16.6N 133.1E	100	64	10	17.9N 129.6E	120	80	-15	19.6N 126.3E	130	33	-20
211800Z	15.9N 136.0E	75	16.0N 135.7E	75	18	0	17.0N 132.1E	105	81	10	18.4N 128.6E	125	77	-15	--.- ---.-	--	--	--
220000Z	16.2N 135.3E	80	16.3N 134.8E	80	29	0	17.3N 131.2E	110	93	5	18.8N 127.7E	130	70	-15	20.6N 124.4E	130	32	0
220600Z	16.5N 134.8E	85	16.6N 134.7E	85	8	0	18.1N 131.7E	105	13	-15	19.4N 128.7E	125	45	-25	--.- ---.-	--	--	--
221200Z	16.8N 134.2E	90	17.0N 134.0E	90	17	0	18.5N 130.9E	115	6	-20	19.7N 127.9E	130	63	-20	20.9N 124.2E	130	143	10
221800Z	17.2N 133.5E	95	17.2N 133.5E	95	0	0	18.6N 130.7E	120	47	-20	19.8N 127.6E	130	114	-10	--.- ---.-	--	--	--
230000Z	17.6N 132.8E	105	17.8N 132.9E	100	13	-5	19.5N 130.3E	125	82	-20	20.8N 127.3E	130	152	0	22.1N 124.1E	130	256	70
230600Z	18.0N 131.9E	120	17.9N 132.1E	110	13	-10	19.2N 129.1E	130	69	-20	20.5N 125.9E	130	155	-5	--.- ---.-	--	--	--
231200Z	18.4N 130.9E	135	18.5N 130.8E	125	8	-10	19.9N 127.4E	140	34	-10	21.1N 123.8E	125	118	5	22.1N 120.1E	110	244	75
231800Z	18.8N 129.9E	140	18.7N 129.9E	135	6	-5	20.5N 126.0E	135	17	-5	21.7N 122.0E	120	91	30	--.- ---.-	--	--	--
240000Z	19.1N 128.9E	145	19.3N 128.9E	140	12	-5	20.8N 125.0E	140	29	10	22.1N 120.4E	120	92	60	--.- ---.-	--	--	--
240600Z	19.4N 127.9E	150	19.6N 127.7E	150	16	0	21.1N 123.8E	135	45	0	22.3N 119.4E	115	126	65	--.- ---.-	--	--	--
241200Z	19.9N 126.8E	150	20.0N 126.8E	150	6	0	21.4N 122.8E	130	68	10	22.5N 118.3E	110	172	75	--.- ---.-	--	--	--
241800Z	20.5N 125.7E	140	20.4N 125.6E	150	8	10	21.9N 121.1E	130	60	40	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250000Z	21.1N 124.6E	130	20.9N 124.5E	130	13	0	22.2N 119.8E	105	78	45	--.- ---.-	--	--	--	--.- ---.-	--	--	--
250600Z	21.8N 123.5E	135	21.8N 123.7E	125	11	-10	24.0N 118.9E	80	30	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251200Z	22.4N 122.2E	120	22.6N 122.3E	120	13	0	23.9N 117.3E	65	78	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
251800Z	22.9N 121.0E	90	22.8N 121.3E	105	18	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
260000Z	23.5N 119.7E	60	23.4N 119.6E	70	8	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
260600Z	24.2N 118.4E	50	24.2N 118.6E	55	11	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
261200Z	25.2N 117.2E	35	24.9N 117.8E	50	37	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORCASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORFCAST ERROR	13NM	63NM	107NM	142NM	15NM	63NM	107NM	142NM
AVERAGE RIGHT ANGLE ERROR	8NM	34NM	41NM	36NM	9NM	34NM	41NM	36NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	15KTS	25KTS	35KTS	5KTS	15KTS	25KTS	35KTS
AVERAGE BIAS OF WIND ERROR	0KTS	3KTS	10KTS	27KTS	0KTS	3KTS	10KTS	27KTS
NUMBER OF FORECASTS	24	23	14	5	27	23	14	5


BEST TRACK
TYPHOON OLIVE
29 JUL-06AUG 1971
CYCLONE 19
MAX SFC WND - 85kts
MINIMUM SLP - 935mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
KURIL ISLANDS
VOLCANO ISLANDS
MARIANAS ISLANDS
MARCUS ISLAND
BONIN ISLANDS

OLIVE

Olive climaxed the most active July on record as another in a succession of circulations in the equatorial trough formed east of Guam on 24 July. After drifting over Guam the system took a northward bend due to the influence of a weak trough to the north. After commencing a northeast drift, the circulation began to grow in size but did not become better organized. By the 29th a rather complex cloud system was in evidence as viewed by satellite. As the subtropical ridge began to strengthen, the depression began to slowly intensify and start an erratic, meandering westerly track, reaching storm status early on the 31st (Figure 5-28). Switching to a northwest direction, Olive finally achieved typhoon force by mid-day of the 2nd. The typhoon reached her peak intensity of 85 kt some 48 hours later as she neared Yaku-Shima in the northern Ryukyus (Figure 5-29).

With the approach of a long-wave trough off the coast of China, the typhoon swung to a northerly track with her center driving through western Kyushu east of Nagasaki on the 5th. Crossing the Ryukyus, the highest winds and lowest pressure were reported at the Japanese Yaku-Shima station with 80 kt gusting to 119 kt and 938.7 mb respectively.

Torrential rains measuring up to 59.8 inches in the mountainous regions of Kyushu (Ebino, Miyazaki prefecture) accounted for numerous landslides and for 69 persons killed, 209 injured, and over 1,700 dwellings partly or completely destroyed. At sea the 7,935-ton motorship KAMO MARU was forced aground off Hesaki Lighthouse while the 975-ton SHINMEI MARU ran aground six miles west of Anami-o-shima.

Weakened considerably by her traverse of Kyushu, Olive entered the Sea of Japan as a tropical storm and paralleled the Korean coast before turning on a northeast course and becoming extratropical.

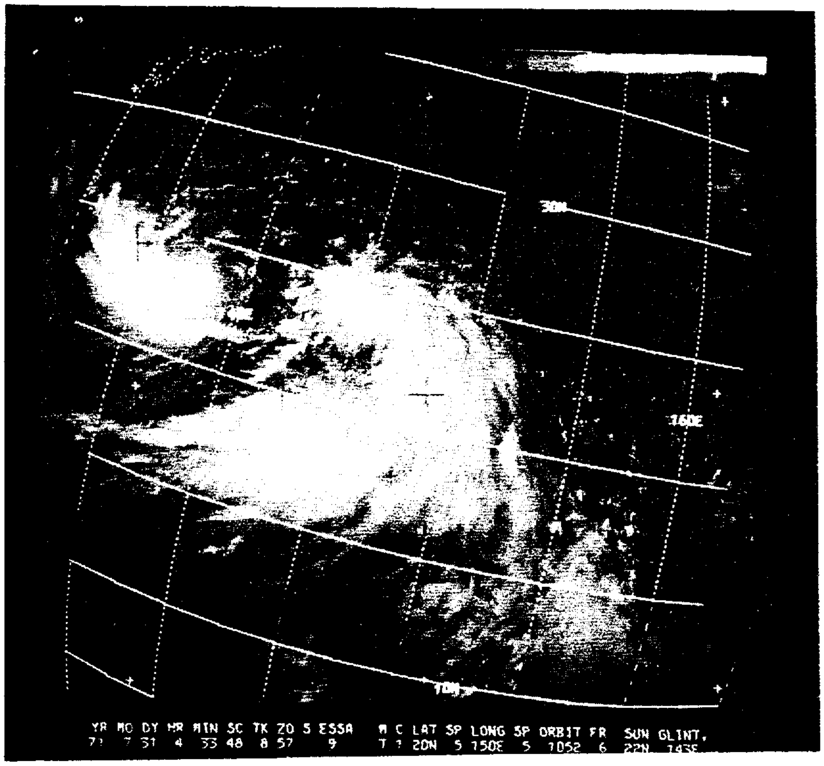


FIGURE 5-28. TROPICAL STORM OLIVE (LEFT) AS A MEMBER OF A LARGE CIRCULATION SYSTEM STRETCHING FROM WEST OF THE BONIN ISLAND GROUP TO MARCUS ISLAND - 31 JULY.

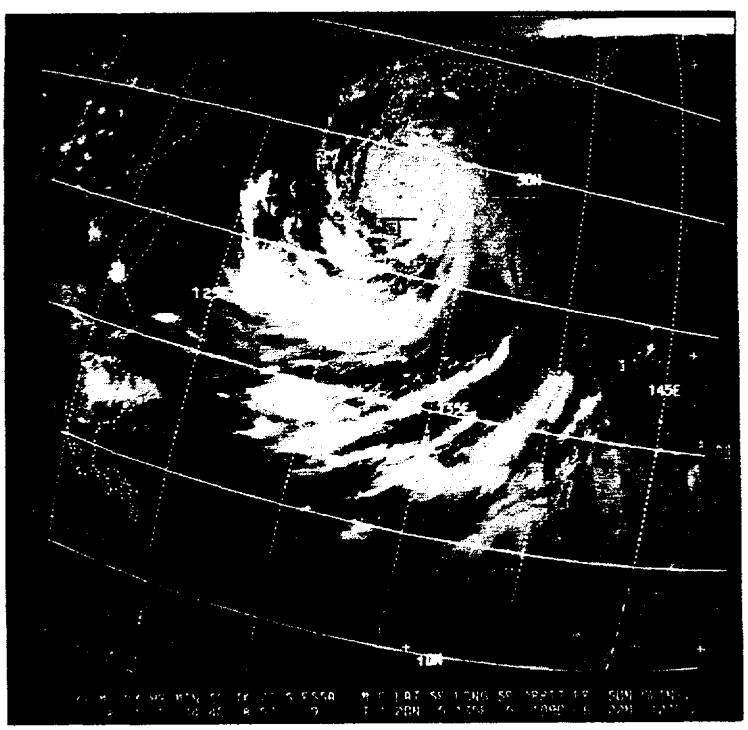


FIGURE 5-29. CAMERAS ABOARD ESSA-9 PHOTOGRAPH TYPHOON OLIVE NEAR THE RYUKYU CHAIN ON 3 AUGUST.

TYPHOON OLIVE
EYE FIXES FOR CYCLONE NO. 19
29 JUL - 06 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	270810Z	16.6N 140.0E	----------	-----	----	----	---*	----	--/--	----	-----	--	--	C141 RDR FIX	
2	290432Z	22.5N 143.0E	SATELIT---	STG C+										FIRST BLTN	
3	291230Z	23.2N 144.3E	54-P-20-10	700MB	35	----	996	3048	09/10	----	-----	--	--	POORLY DEFINED	
4	291500Z	23.5N 143.5E	54-P- 5-10	700MB	40	----	994	3030	10/10	----	-----	--	--	700MB CNTR FIX	
5	292224Z	23.8N 142.8E	VQ-P- 3- 2	360M	----	30	990	----	27/23	----	-----	--	--	WIND EYE 2NM DIA	
6	300430Z	24.3N 141.7E	54-P-15-10	700MB	30	----	991	2990	11/11	----	-----	--	--	700MB CNTR FIX NEG RDR PRES	
7	300531Z	24.5N 141.2E	SATELIT---	STG C										LESS INTENSE	
8	300958Z	24.0N 141.0E	54-P- 5---	700MB	26	----	987	2981	15/13	ELIP	N-S	20X10	--	WK CLSD WC-700 MB CNTR FIX	
9	301121Z	24.0N 140.8E	54-P------	700MB	----	----	---*	2987	--/--	----	-----	--	--		
10	301532Z	23.7N 140.3E	VQ-R-25---	-----	----	----	---*	----	--/--	----	-----	--	--	EST POSIT	
11	301630Z	24.0N 140.1E	VQ-P-10- 5	-----	----	40	986	----	26/24	----	-----	25	--	WC OPEN S SEMIC	
12	302130Z	24.0N 139.4E	VQ-P-12- 8	-----	----	40	987	----	27/25	----	-----	20	--	WC OPEN N SEMIC	
13	310400Z	23.7N 138.5E	54-P- 3- 5	700MB	41	40	979	2935	19/15	----	-----	--	--	SFC CNTR WELL DEF -700 CNTR 10NM S	
14	310434Z	24.0N 137.5E	SATELIT---	STG C+										STRONGER	
15	310915Z	23.9N 138.2E	54-P- 2- 6	700MB	40	40	979	2929	18/12	----	-----	--	--	POORLY DEF-700MB CNTR 21NM SW	
16	311630Z	23.1N 137.4E	54-P- 8---	700MB	30	----	976	2890	19/10	----	-----	--	--	NO WC-700 CNTR FX	
17	312101Z	23.6N 137.3E	54-P- 8---	700MB	45	40	978	2886	16/15	ELIP	NE-SW	20X 5	--	POORLY DEFINED	
18	010517Z	24.1N 136.7E	VQ-P- 2- 2	700MB	58	60	971	2762	27/24	----	-----	--	--	WC OPEN NE-S	
19	010533Z	24.5N 136.0E	SATELIT---	STG X	DIA	2	CAT 2.0							STRONGER	
20	010936Z	24.5N 136.1E	VQ-P- 8- 2	700MB	60	65	967	2737	27/25	----	-----	30	--	WC OPEN NE	
21	011600Z	24.2N 135.4E	54-P- 3- 2	700MB	50	----	966	2807	16/16	ELIP	N-S	20X16	--	CLSD WC	
22	012200Z	24.7N 135.1E	54-P- 2- 3	700MB	60	65	966	2819	16/13	----	-----	20	--	WC POORLY DEF	
23	020421Z	25.0N 134.2E	54-P- 5---	700MB	55	55	974	2847	12/10	----	-----	--	--	VERY POORLY DEF	
24	020440Z	25.0N 135.0E	SATELIT---	STG X	DIA	3	CAT 3.0							SML EYE VISIBLE	
25	020628Z	25.4N 134.5E	54-P- 5---	700MB	60	60	---*	2716	15/11	ELIP	E-W	20X10	--	POORLY DEF-SFC CNTR 15NM ENE	
26	020901Z	25.6N 134.4E	54-P- 5---	700MB	60	70	957	2679	19/12	ELIP	E-W	40X20	--	POORLY DEF-SFC CNTR 5NM E	
27	021300Z	25.8N 133.5E	VQ-R-15-10	-----	----	----	---*	----	--/25	----	-----	25	8	CLSD WC	
28	021630Z	26.3N 133.4E	VQ-P-13- 3	700MB	----	----	960	2737	17/15	----	-----	25	7	CLSD WC	
29	021817Z	26.5N 133.4E	VQ-P- 8- 3	700MB	----	----	961	2771	17/13	----	-----	20	8	CLSD WC-ROTATING 30 DEG/HR	
30	030004Z	27.2N 132.8E	54-R------	-----	----	----	---*	----	--/--	----	-----	--	--	FST POSIT	
31	030100Z	27.3N 132.7E	54-P- 3- 2	700MB	70	80	948	2646	16/16	----	-----	15	10	CLSD WC-700MB CNTR 4NM NW	
32	030200Z	27.5N 132.5E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
33	030400Z	27.7N 132.3E	54-P- 2- 5	700MB	70	----	945	2618	16/14	----	-----	15	10	CLSD WC-700 FIX	
34	030500Z	27.8N 132.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
35	030535Z	28.0N 132.0E	SATELIT---	STG X	DIA	4	CAT 4.0								
36	030600Z	28.0N 132.1E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
37	030653Z	28.1N 131.9E	VQ-P- 2- 2	700MB	70	75	945	2518	26/24	----	-----	15	7	CLSD WC	
38	030700Z	28.2N 131.9E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
39	030700Z	28.1N 131.9E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
40	030700Z	28.1N 132.8E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
41	030800Z	28.4N 131.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
42	030800Z	28.4N 131.6E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E

TYPHOON OLIVE

EYE FIXES FOR CYCLONE NO. 19

29 JUL - 06 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIENTATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
43	030800Z	28.2N 131.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
44	030900Z	28.3N 131.5E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
45	030900Z	28.5N 131.4E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
46	030900Z	28.5N 131.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
47	030953Z	28.3N 131.4E	VQ-P- 2- 2	700MB	----	75	943	2536	27/25	----	-----	14	7	CLSD WC	
48	031000Z	28.4N 131.3E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
49	031000Z	28.5N 131.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
50	031000Z	28.5N 131.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
51	031100Z	28.5N 131.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
52	031100Z	28.4N 131.1E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
53	031100Z	28.5N 131.1E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
54	031200Z	28.4N 131.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
55	031226Z	28.5N 130.9E	VQ-P- 3- 2	700MB	----	----	942	2646	19/16	ELIP	N-S	17X13	7	CLSD WC	
56	031300Z	28.5N 130.9E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
57	031300Z	28.4N 130.9E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
58	031300Z	28.4N 130.8E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
59	031400Z	28.5N 130.8E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
60	031400Z	28.4N 130.8E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
61	031500Z	28.5N 130.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
62	031500Z	28.4N 130.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
63	031500Z	28.5N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
64	031600Z	28.5N 130.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
65	031600Z	28.4N 130.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
66	031600Z	28.4N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
67	031625Z	28.6N 130.6E	54-P- 2- 2	700MB	75	----	935	2554	19/16	----	-----	18	--	CLSD WC	
68	031700Z	28.5N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
69	031700Z	28.6N 130.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
70	031700Z	28.5N 130.8E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
71	031800Z	28.6N 130.8E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
72	031800Z	28.6N 130.8E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
73	031900Z	28.9N 130.5E	54-P- 2- 2	700MB	65	----	930	2536	18/16	----	-----	16	--	CLSD WC	
74	032000Z	28.8N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
75	032030Z	29.1N 130.4E	54-P- 2---	700MB	70	----	----	2545	18/16	----	-----	12	10	CLSD WC	
76	032100Z	29.0N 130.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
77	032100Z	29.1N 130.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
78	032100Z	28.9N 130.6E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
79	032200Z	29.0N 130.6E	LND RDR---							----	-----	--	--	STN RJTD	35.7N 139.0E
80	032300Z	29.5N 130.6E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
81	040000Z	29.4N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
82	040000Z	29.2N 130.5E	LND RDR---							----	-----	--	--	OKINAWA RDR	
83	040100Z	29.5N 130.4E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
84	040100Z	29.3N 130.5E	LND RDR---							----	-----	--	--	OKINAWA RDR	
85	040115Z	29.5N 130.4E	LND RDR---							----	-----	--	--	ITAZUKI RDR	33.6N 130.4E
86	040200Z	29.5N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
87	040200Z	29.5N 130.5E	LND RDR---							----	-----	--	--	OKINAWA RDR	
88	040300Z	29.7N 130.0E	LND RDR---							----	-----	--	--	OKINAWA RDR	
89	040400Z	29.7N 130.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
90	040400Z	29.6N 130.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
91	040400Z	30.0N 129.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
92	040442Z	29.5N 130.0E	SATELIT---	STG X DIA 3 CAT 3.0											

TYPHOON OLIVE
EYE FIXES FOR CYCLONE NO. 19
29 JUL - 06 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
93	040500Z	29.6N 130.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
94	040500Z	29.7N 130.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
95	040700Z	29.6N 130.2E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
96	040700Z	29.6N 130.3E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
97	040700Z	29.6N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
98	040700Z	29.7N 129.8E	54-P- 0- 2	500MB	45	65	940	2371	03/03	----	-----	10	5	WC OPEN NW QUAD	
99	040800Z	29.8N 130.4E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
100	040800Z	29.8N 130.4E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
101	040800Z	29.7N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
102	040900Z	29.8N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
103	040900Z	30.2N 130.3E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
104	041000Z	30.3N 130.5E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
105	041000Z	30.3N 130.5E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
106	041000Z	30.2N 130.4E	54-P- 0- 5	700MB	----	----	935	2357	20/19	----	-----	--	--	WC BREAKING UP	
107	041000Z	30.2N 130.3E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
108	041000Z	30.3N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
109	041100Z	30.5N 130.6E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
110	041100Z	30.4N 130.2E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
111	041100Z	30.8N 130.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
112	041130Z	30.6N 130.2E	54--------	-----	----	----	----	----	--/--	----	-----	--	--	EYE FILLING	
113	041200Z	30.7N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
114	041200Z	30.5N 130.0E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
115	041200Z	30.6N 130.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
116	041300Z	30.7N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
117	041300Z	30.8N 129.7E	54-P- 0- 2	500MB	----	----	945	2392	02/02	----	-----	--	--	NO WC	
118	041400Z	30.7N 129.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
119	041400Z	30.7N 129.9E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
120	041500Z	30.7N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
121	041500Z	30.8N 130.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
122	041500Z	30.7N 129.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
123	041500Z	30.0N 130.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
124	041600Z	30.8N 129.8E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
125	041600Z	30.9N 129.9E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
126	041606Z	30.7N 129.9E	VQ-R- 1---	-----	----	----	----	----	--/--	----	-----	11	--	HOLE IN RDR PRES	30.7N 128.8E
127	041700Z	31.0N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
128	041852Z	31.1N 130.0E	VQ-P- 1- 2	700MB	----	----	947	2600	20/13	----	-----	14	3	WC OPEN W SEMIC	
129	041900Z	31.2N 130.1E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
130	042130Z	31.7N 130.1E	VQ-P- 1- 9	700MB	----	----	935	2554	17/13	----	-----	--	--	NEG RDR PRES	
131	050100Z	32.7N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
132	050100Z	32.6N 130.4E	54-P- 2- 6	700MB	93	----	----	2624	15/13	----	-----	--	--	NEG RDR PRES	
133	050200Z	33.0N 130.4E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
134	050200Z	32.4N 130.2E	LND RDR---							----	-----	--	--	STN RJTT	35.5N 139.8E
135	050300Z	33.4N 130.4E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
136	050410Z	33.6N 130.2E	54-P- 2- 4	700MB	45	----	----	2719	17/15	----	-----	10	--	POORLY DEFINED	
137	050541Z	34.0N 130.0E	SATELIT---	STG X	DIA	4	CAT 2.V							WEAKENING	
138	050700Z	34.3N 130.1E	54-P- 3---	700MB	65	35	972	2795	16/14	----	-----	25	--	WK WC N AND SW	
139	050900Z	34.6N 130.4E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
140	051000Z	34.9N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
141	051000Z	34.9N 130.7E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
142	051000Z	35.0N 130.6E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E

TYPHOON OLIVE
EYE FIXES FOR CYCLONE NO. 19
29 JUL - 06 AUG 71

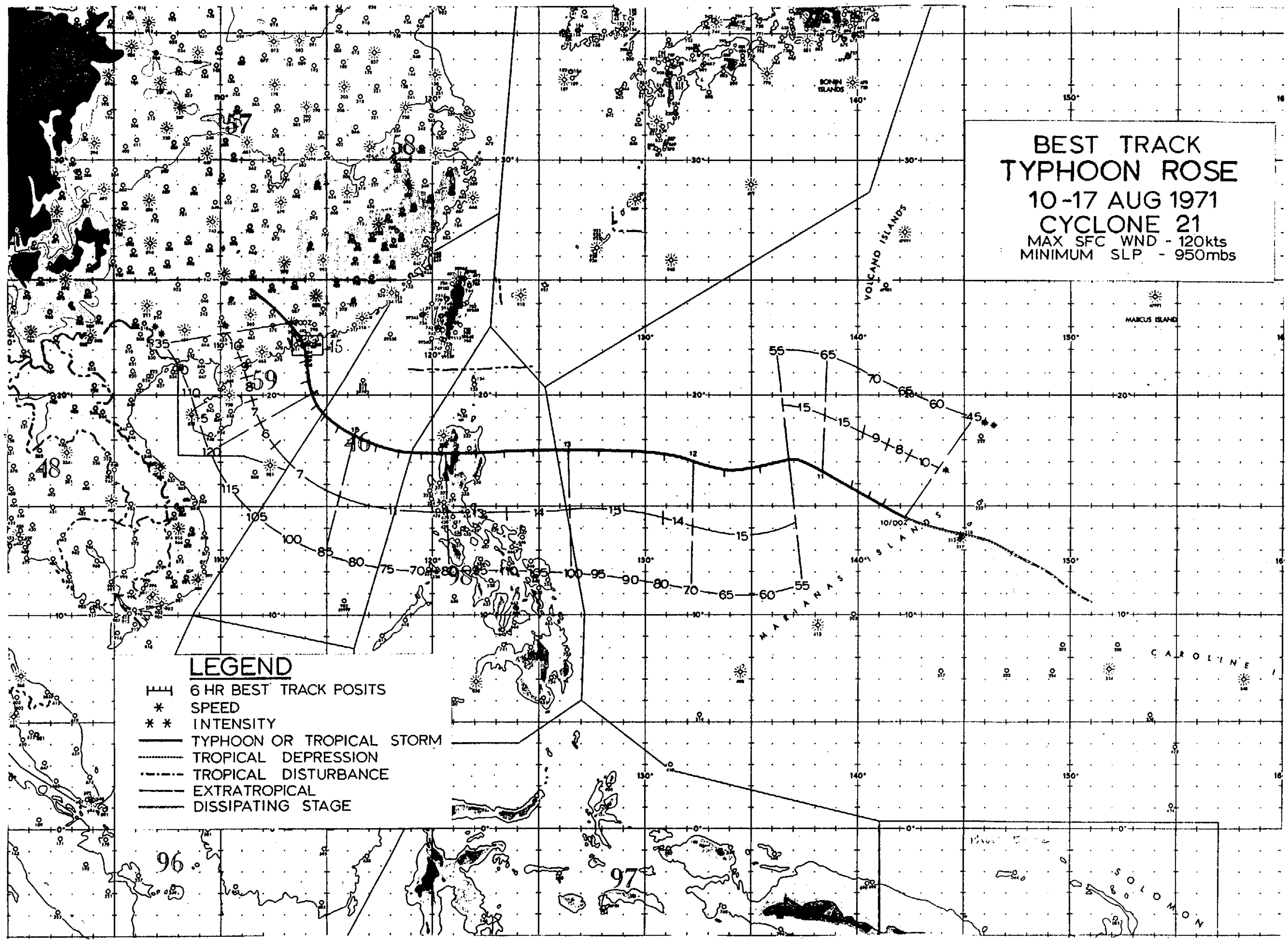
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
143	051000Z	35.3N 130.3E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
144	051100Z	35.2N 130.8E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
145	051200Z	35.7N 130.8E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
146	051200Z	35.9N 130.8E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
147	051200Z	35.7N 130.8E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
148	051200Z	35.7N 130.9E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
149	051300Z	36.0N 130.8E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
150	051300Z	36.1N 131.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
151	051400Z	36.2N 130.8E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
152	051500Z	36.4N 130.9E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
153	051520Z	36.5N 130.8E	VQ-P-25---	300M	----	55	982	----	23/21	----	-----	--	--	NO WC	
154	051600Z	36.8N 130.9E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E

TYPHOON OLIVE

0600Z 29 JUL TO 0000Z 6 AUG

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
290600Z	22.8N 143.5E	25	22.0N 142.0E	30	96	5	23.2N 140.8E	60	74	30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	23.2N 144.3E	25	24.3N 143.6E	30	76	5	25.7N 144.3E	35	220	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291800Z	23.7N 143.4E	25	23.5N 143.5E	30	13	5	23.8N 142.5E	50	148	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300000Z	24.0N 142.5E	30	23.9N 142.7E	30	12	0	25.1N 140.4E	45	101	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300600Z	24.2N 141.6E	30	24.4N 141.6E	30	12	0	25.9N 138.2E	45	126	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301200Z	24.0N 140.7E	30	24.2N 140.6E	30	13	0	25.8N 137.2E	45	130	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301800Z	24.0N 139.8E	35	24.0N 139.9E	40	5	5	24.5N 136.4E	50	82	0	25.6N 133.1E	60	139	0	--.- ---.-	--	--	--
310000Z	23.9N 139.1E	40	24.0N 139.1E	40	6	0	24.7N 135.9E	45	72	-10	25.7N 132.6E	50	135	-10	27.2N 129.5E	60	175	-1[illegible]
310600Z	23.8N 138.3E	40	23.8N 138.2E	40	5	0	24.2N 134.8E	45	87	-15	25.5N 131.6E	50	162	-10	--.- ---.-	--	--	--
311200Z	23.7N 137.8E	45	23.8N 138.0E	40	12	-5	23.9N 136.2E	45	34	-15	24.5N 133.7E	60	81	-5	25.7N 131.4E	70	168	-1[illegible]
311800Z	23.4N 137.3E	50	23.3N 137.3E	40	6	-10	23.6N 135.6E	50	51	-10	24.6N 133.2E	60	108	-5	--.- ---.-	--	--	--
010000Z	23.9N 136.9E	65	23.7N 137.0E	45	13	-10	24.0N 134.7E	55	49	-5	25.3N 131.9E	60	123	-15	26.7N 129.7E	60	158	-2[illegible]
010600Z	24.3N 136.4E	60	24.1N 136.5E	55	13	-5	24.6N 134.3E	65	45	5	25.7N 131.4E	75	135	-5	--.- ---.-	--	--	--
011200Z	24.4N 135.9E	60	24.0N 135.8E	65	13	5	25.4N 132.9E	75	69	10	26.6N 130.1E	65	125	-20	28.0N 128.0E	60	187	-2[illegible]
011800Z	24.4N 135.3E	60	24.4N 135.2E	65	5	5	25.2N 132.8E	75	79	10	26.6N 130.1E	65	139	-20	--.- ---.-	--	--	--
020000Z	24.8N 134.9E	60	24.7N 134.9E	70	6	10	25.2N 132.9E	70	120	-5	26.5N 130.1E	70	167	-15	28.0N 128.0E	70	288	[illegible]
020600Z	25.3N 134.6E	60	25.1N 134.1E	70	30	10	26.1N 131.7E	70	109	-10	27.6N 129.1E	70	144	-15	--.- ---.-	--	--	--
021200Z	25.8N 134.1E	65	25.9N 134.2E	70	8	5	27.5N 132.3E	75	87	-10	29.0N 130.1E	70	84	-15	30.8N 128.4E	70	307	1[illegible]
021800Z	26.4N 133.4E	65	26.4N 133.3E	70	5	5	28.3N 131.3E	75	55	-10	30.3N 129.7E	70	49	-5	--.- ---.-	--	--	--
030000Z	27.2N 132.8E	75	26.9N 132.8E	70	18	-5	28.7N 131.0E	70	55	-15	30.7N 129.5E	60	109	-5	--.- ---.-	--	--	--
030600Z	27.9N 132.0E	80	27.8N 132.1E	80	8	0	30.4N 129.8E	75	30	-10	33.8N 128.7E	55	70	-5	--.- ---.-	--	--	--
031200Z	28.5N 131.1E	85	28.7N 131.3E	80	16	-5	31.8N 128.9E	65	110	-20	35.8N 130.2E	55	23	0	--.- ---.-	--	--	--
031800Z	28.9N 130.5E	85	28.8N 130.4E	80	8	-5	32.1N 128.7E	60	85	-15	36.2N 130.7E	50	78	0	--.- ---.-	--	--	--
040000Z	29.3N 130.2E	85	29.4N 130.4E	80	12	-5	32.0N 128.8E	65	79	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
040600Z	29.9N 129.9E	85	29.8N 129.8E	75	8	-10	32.2N 128.8E	60	121	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
041200Z	30.4N 130.3E	85	30.5N 130.0E	75	17	-10	33.0N 129.5E	60	165	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
041800Z	31.1N 129.9E	75	30.9N 129.8E	75	13	0	33.3N 129.6E	60	257	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
050000Z	32.4N 130.3E	65	32.1N 130.0E	65	23	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
050600Z	33.9N 130.1E	60	34.0N 130.6E	65	25	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051200Z	35.6N 130.6E	55	35.6N 131.3E	55	34	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051800Z	37.5N 130.7E	50	37.5N 131.1E	50	19	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	13NM	94NM	110NM	214NM	18NM	98NM	110NM	214NM
AVERAGE RIGHT ANGLE ERROR	10NM	47NM	71NM	118NM	13NM	50NM	71NM	118NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	9KTS	9KTS	17KTS	4KTS	9KTS	9KTS	17KTS
AVERAGE BIAS OF WIND ERROR	-1KTS	-3KTS	-9KTS	-10KTS	-0KTS	-2KTS	-9KTS	-10KTS
NUMBER OF FORECASTS	25	25	17	6	31	27	17	6


BEST TRACK
TYPHOON ROSE
10-17 AUG 1971
CYCLONE 21
MAX SFC WND - 120kts
MINIMUM SLP - 950mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARCUS ISLAND
BONIN ISLANDS
MARIANAS ISLANDS
CAROLINE I
SOLOMON

During her early life, Rose was in a class of midget typhoons having an area extent of 100-150 miles (Figure 5-30). Before her life cycle was spent, however, Rose had the distinction of being the most disasterous typhoon of the 1971 season.

A small circulation was evident in synoptic and satellite data as early as the 7th at a position north of Truk. On the evening of August 9th, the radars at Fleet Weather Central Guam and Andersen AFB, Guam detected a small circulation with spiraling convection passing just north of Guam. Aircraft investigation the following morning revealed a mini-storm with 35- to 40-kt winds. By the late afternoon, Rose coiled to minimum typhoon strength with no increase in size and set out on a westerly course at 14-15 kt for Luzon. Except for a 12-hour period during the late afternoon and evening of the 11th, Rose remained at typhoon strength as she navigated the Philippine Sea and gradually generated winds to 110 kt before striking Luzon.

It is noteworthy that, although Rose exhibited typhoon-force winds, the central pressures observed by reconnaissance aircraft were unusually high for the standard pressure-wind relationships used at JTWC (Takahasi, 1939). It is believed the small size and tight gradients associated with Rose were responsible for this anomaly.

Making landfall north of Palanan Point, Rose crossed the mountainous terrain of northern Luzon and emerged in the South China Sea as a minimal typhoon. While inland, the Philippine Weather Bureau station at Tuguegarao reported maximum winds of 75 kt and the barometer dipped to 986.5 mb during center passage.

Rose had been steered for several days by a strong high cell centered near Shanghai. This cell began to weaken significantly as Rose began her journey in the South China Sea. In response to the synoptic-scale changes, the typhoon shifted to a more northwesterly course and began to slow to 6-7 kt in forward movement later on the 15th. Aircraft reconnaissance reports indicated deepening was taking place before Rose crossed the no-fly zone as the central pressure dropped from 980 mb to 959 mb in ten hours during the 15th.

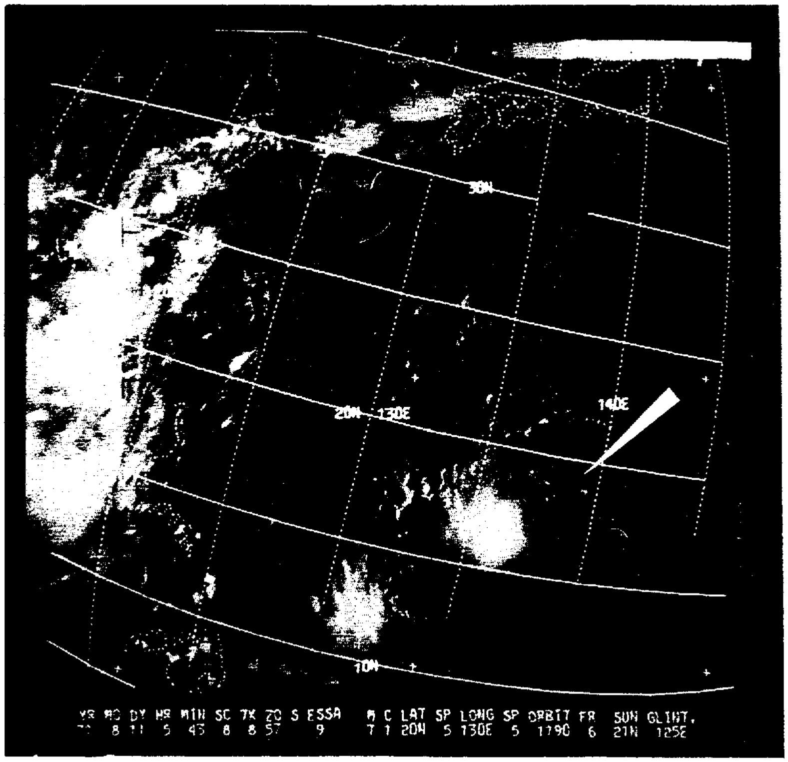


FIGURE 5-30. MINI-TYPHOON ROSE AS PHOTOGRAPHED BY ESSA-9 ON 11 AUGUST.

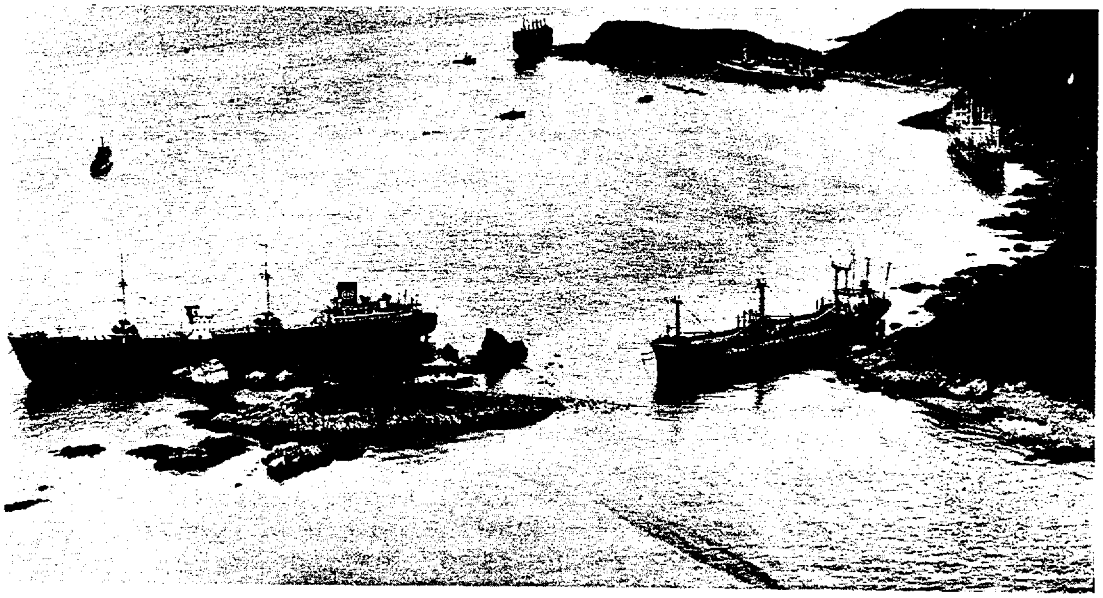
FIGURE 5-31. RADARSCOPE PICTURE OF ROSE TAKEN AT 0400 GMT 16 AUGUST 1971 FROM THE ROYAL OBSERVATORY'S RADAR (RANGE MARKS 40 N MI)--COURTESY ROYAL OBSERVATORY HONG KONG.

The eye of the storm began to appear on the radar at the Royal Observatory the afternoon of the 16th (Figures 2-15 and 5-31), while a ship report in the vicinity of the eye confirmed that the deepening trend had continued to 950 mb. The SS NUDDEA reported winds of 90-110 kt close to the center. Considering last reports from aircraft penetration of Rose and the continued deepening trend, the typhoon probably peaked near 120 kt at this time before weakening slightly when the eye arrived at Lantau Island off Hong Kong shortly after midnight of the 16th. Moving inland on the 17th, the storm weakened and dissipated northeast of Canton the following day.

Meteorological extremes measured within the colony showed a minimum pressure of 963.2 mb at Cheang Chau after midnight while a maximum gust of 121 kt was reported at the Royal Observatory. The 11.34 inches of rain which fell at the Observatory during the 24 hours of Rose's passage was the highest value ever recorded in one calendar day in August.

Typhoon Rose was probably one of the most intense and violent typhoons that has affected Hong Kong. Twenty-six ocean-going vessels went aground and two were sunk (Table 5-1). A total of 130 deaths was attributable to the typhoon and over 5,600 people were made homeless. Also in the harbor, some 300 small craft including 100 pleasure craft were sunk or damaged (Figure 5-32).

The Macao ferry FATSHAN capsized resulting in the loss of 88 crew members and is regarded as one of the worst maritime disasters in the colony's history.



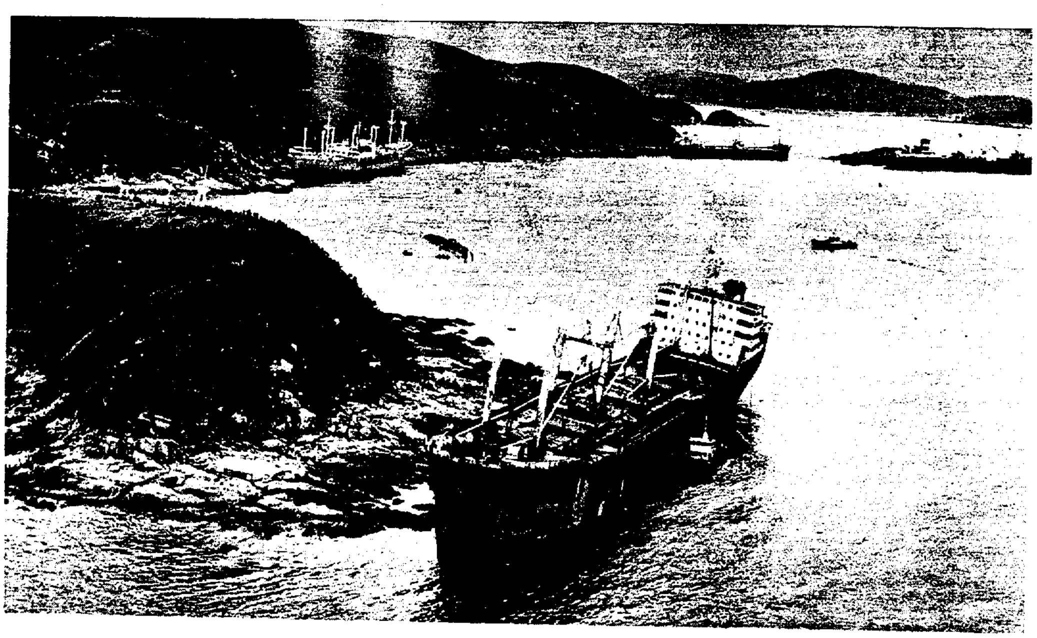


FIGURE 5-32. VICTIMS OF TYPHOON ROSE, FREIGHTERS RUN AGROUND ON LANTAO ISLAND, HONG KONG SURROUND THE CAPSIZED MACAO-HONG KONG FERRY, FATSHAN. (VESSELS AS SEEN IN THE TOP AND BOTTOM VIEWS INCLUDE THE FERNBANK, WINDFIELD TRADER, GALLANTRY, KOYOHO MARU AND KAOSHSIUNG--COURTESY THE SOUTH CHINA MORNING POST.

TABLE 5-1. LISTING OF VESSEL CASUALTIES INCURRED AT HONG KONG DURING TYPHOON ROSE*

VESSEL	FLAG	TONNAGE
GREEN BAY	United States	11,021
FLYING DRAGON	United States	8,243
REGULUS	United States	---
AMERICAN HAWK	United States	7,909
FATSHAN (Ferry)	British Commonwealth	2,637
RED SEA	British Commonwealth	7,026
DWARKA	British Commonwealth	4,851
HUNTSLAND	British Commonwealth	9,353
EASTERN CAPE	British Commonwealth	6,205
JADE LILY	British Commonwealth	11,753
SEA CORAL	British Commonwealth	10,421
LEE HONG (Ferry)	British Commonwealth	1,127
MACAU (Ferry)	British Commonwealth	3,670
KIM SENG	British Commonwealth	---
GALLANTRY	Panama	7,582
MONRUBY	Panama	5,312
WINFIELD TRADER	Panama	11,038
KAOHSIUNG	Panama	1,289
TIEN HONG	Liberia	12,417
BILLY	Liberia	8,705
SHONAN MARU	Japanese	2,116
KYOHO MARU	Japanese	2,998
LAOSHAN	Somali	10,087
TAIPIENG	Somali	5,676
NURITH	Israel	6,982
COMANDANTE CAMILO CIENFUEGOS	Cuba	9,735
WORLD DALE	Greece	15,729
KOTA SENTOSA	Singapore	---
JILIN	China	6,804
FERNBANK	Norway	8,981
GUIMARAS	Philippines	3,555
WATUDAMBO	Indonesia	2,165
TUNG THAI	Taiwan	2,492
WAH FAT	Taiwan	---
ARISA	Taiwan	---

*SOURCE - 1. Casualty Returns, The Liverpool Underwriters' Association - Aug 1971.
2. Mariner's Weather Log, NOAA - Vol 16, No 1

TYPHOON ROSE
EYE FIXES FOR CYCLONE NO. 21
10 AUG - 17 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	080600Z	11.3N 149.5E	54-P-------	700MB	----	----	----	----	--/--	----	-----	--	--	INVESTIGATIVE FIX	
2	090537Z	12.5N 145.0E	SATELIT---	STG B										FIRST BLTN	
3	091000Z	13.6N 145.1E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
4	091100Z	13.8N 144.6E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
5	091115Z	13.9N 144.6E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
6	091140Z	13.9N 144.5E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
7	091200Z	13.9N 144.5E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
8	091210Z	13.8N 144.6E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
9	091215Z	14.0N 144.5E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
10	091240Z	14.0N 144.6E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
11	091315Z	13.8N 144.2E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
12	091340Z	13.9N 144.2E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
13	091415Z	13.9N 144.1E	LND RDR---							----	-----	--	--	GOOD FIX-91218	13.6N 144.9E
14	091420Z	13.8N 144.0E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
15	091440Z	13.9N 144.1E	LND RDR---							----	-----	--	--	FAIR FIX-91218	13.6N 144.9E
16	091515Z	14.2N 143.8E	LND RDR---							----	-----	--	--	PSBL CNTR-91218	
17	091525Z	13.9N 143.7E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
18	091655Z	14.0N 143.1E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
19	092020Z	14.2N 142.1E	LND RDR---							----	-----	--	--	FWC RDR	13.5N 144.7E
20	092215Z	14.2N 142.4E	54-P- 1- 2	700MB	30	35	1000	3057	10/08	ELIP	N-S	20X15	--	WEAK EYE	
21	100415Z	14.9N 141.5E	VQ-R-25---	-----	----	75	----	----	--/--	CIRC		10	4	RADIUS 30KT WINDS	14.4N 142.3E
														30 NM	
22	100444Z	15.0N 141.5E	SATELIT---	STG C										STRONGER	
23	101016Z	15.4N 140.8E	VQ-R- 8---	-----	----	----	----	----	--/--	CIRC		10	7	WC OPEN E SEMIC	15.0N 140.2E
24	101715Z	15.7N 139.9E	54-P- 5- 5	700MB	60	----	996	3030	18/12	CIRC		15	--	WC OPEN E SEMIC	
25	102010Z	16.0N 139.2E	54-P-------	700MB	60	----	----	3030	18/--	----	-----	--	--		
26	102200Z	16.2N 138.8E	54-P- 2- 3	700MB	57	75	997	3048	18/11	CIRC		12	--	WC OPEN NE-SE	
														SFC CNTR 3NM S	
27	110352Z	17.0N 137.3E	VQ-P- 5---	-----	50	45	999	----	28/23	----	-----	--	--	NO WC-SML WND EYE	
28	110543Z	17.0N 136.5E	SATELIT---	STG X	DIA	3	CAT 2.0							STRONGER	
29	110624Z	17.2N 136.6E	VQ-P- 5---	-----	----	45	----	----	--/--	----	-----	--	--		
30	110939Z	16.9N 136.2E	VQ-P- 4- 2	-----	45	40	997	----	32/25	----	-----	--	--	POORLY ORGANIZED	
31	111630Z	16.8N 134.0E	54-P-10-10	700MB	22	----	1001	3075	13/12	----	-----	--	--	NO WC-700MB FIX	
32	112142Z	16.9N 132.8E	54-P-10-10	700MB	30	----	1000	3088	10/12	----	-----	--	--	RDR PRES VRY POOR	
33	120558Z	17.5N 131.0E	VQ-P- 5---	-----	----	80	980	----	27/25	CIRC		3	--	NO WC-WIND EYE	
34	120642Z	17.5N 130.5E	SATELIT---	STG X	DIA	3	CAT 2.0							NO EYE VISIBLE	
35	122335Z	17.8N 126.5E	54-P- 2- 3	700MB	90	100	980	2957	18/13	CIRC		20	5	WEAK BRKN WC	
36	130340Z	17.6N 125.6E	54-P- 2- 1	700MB	75	100	970	2920	18/11	CIRC		15	5	WC OPEN N QUAD	
37	130545Z	18.0N 125.0E	SATELIT---	STG X	DIA	3	CAT 3.0							NO EYE VISIBLE	
38	131000Z	17.6N 123.9E	VQ-R- 2- 3	-----	----	----	----	----	--/26	CIRC		20	--	NO WC	18.0N 124.8E
39	131315Z	17.6N 123.2E	VQ-R- 5---	-----	----	120	----	----	26/23	CIRC		8	--	NO WC	18.3N 122.9E
40	131526Z	17.6N 122.6E	VQ-R- 3---	-----	----	----	----	----	--/--	----	-----	--	--	NO WC	18.0N 123.7E
41	131925Z	17.4N 121.6E	54-P-10---	500MB	----	----	----	----	-1/-4	----	-----	--	--	NO WC	
42	132102Z	17.3N 121.3E	54-P-10---	500MB	83	----	----	----	--/--	----	-----	--	--	NO WC	
43	140002Z	17.3N 120.6E	54-P-10---	500MB	----	----	----	----	--/--	----	-----	--	--	NO WC	
44	140425Z	17.5N 120.0E	54-P- 1- 5	700MB	60	65	987	2953	13/10	CIRC		8	--	RDR PRES POOR	
45	140644Z	18.0N 119.5E	SATELIT---	STG X	DIA	3	CAT 3.0							RAGGED EYE	
46	140945Z	17.5N 119.0E	54-P- 1- 4	700MB	80	70	987	2951	14/10	CIRC		30	12	WC CLSD W BRKS	
47	142144Z	18.5N 116.4E	54-P- 2---	700MB	78	----	980	2917	16/13	CIRC		30	--	CLSD WC-CS OVC	
48	150032Z	18.4N 116.3E	VQ-P- 5---	700MB	77	45	980	2911	14/09	CIRC		50	--	WC OPEN NE	

TYPHOON ROSE
EYE FIXES FOR CYCLONE NO. 21
10 AUG - 17 AUG 71

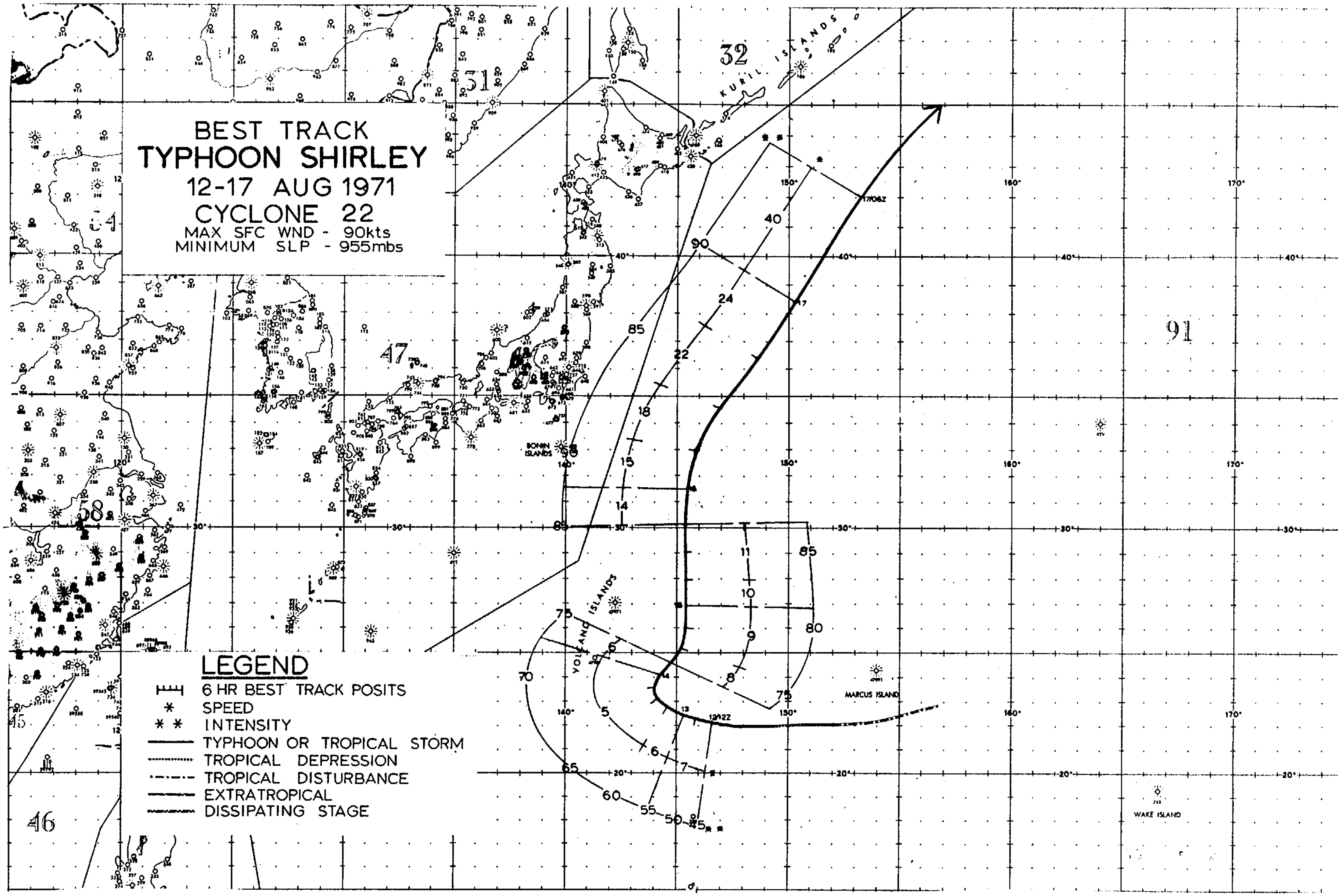
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
49	150303Z	18.3N 115.9E	VQ-P- 1---	700MB	72	60	980	2917	15/11	CIRC		45	--	CLSD WC-CS OVC	
50	150547Z	18.5N 115.5E	SATELIT---	STG X	DIA	2 CAT	3.5							EYE BRLY VISIBLE	
51	150720Z	18.8N 115.5E	54-P- 3- 3	700MB	100	115	966	2798	19/12	CIRC		25	4	CLSD WC	
52	151000Z	19.0N 115.0E	54-P- 3- 3	700MB	100	130	962	2780	19/11	CIRC		20	5	CLASSIC RDR PRES	
53	151300Z	19.3N 114.6E	54-P- 5- 5	700MB	90	----	961	2768	19/11	CIRC		25	5	CLSD WC	
54	151400Z	19.2N 114.5E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
55	151500Z	19.3N 114.8E	54-P- 3- 3	700MB	100	----	959	2746	19/14	CIRC		25	5	CLSD WC	
56	151912Z	19.6N 114.5E	VQ-R- 3- 5	-----	----	----	----	----	--/--	CIRC		13	--	WC OPEN W	18.9N 114.8E
57	152100Z	19.9N 114.3E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
58	152220Z	19.9N 114.3E	VQ-R- 3- 5	-----	----	----	----	----	--/--	CIRC		15	--	WC OPEN S	18.7N 114.6E
59	160000Z	20.2N 114.2E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
60	160015Z	20.1N 114.1E	VQ-R- 7- 3	-----	----	----	----	----	--/--	CIRC		15	--	WC OPEN W	19.3N 115.2E
61	160100Z	20.5N 114.1E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
62	160200Z	20.5N 114.1E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
63	160300Z	20.6N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
64	160400Z	20.8N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
65	160500Z	20.8N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
66	160600Z	20.9N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
67	160646Z	21.0N 114.0E	SATELIT---	STG X	DIA	3	CAT 3.5							RAGGED EYE	
68	160700Z	21.0N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
69	160900Z	21.2N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E
70	161100Z	21.4N 114.0E	LND RDR---							----	------	--	--	GOOD FIX-VHHH	22.3N 114.2E

TYPHOON ROSE

0000Z 10 AUG TO 0000Z 17 AUG

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
100000Z	14.6N 142.2E	45	14.3N 142.2E	30	18	-15	15.3N 138.2E	45	72	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100600Z	15.1N 141.3E	60	14.8N 141.1E	65	21	5	16.5N 137.4E	90	50	35	17.8N 134.3E	110	194	30	--.- ---.-	--	--	--
101200Z	15.5N 140.5E	65	15.5N 140.5E	70	0	5	16.8N 136.8E	95	86	35	18.1N 133.7E	115	246	25	19.8N 130.7E	130	433	20
101800Z	15.9N 139.7E	70	15.8N 139.8E	70	8	0	17.0N 136.4E	95	149	30	18.3N 133.2E	115	303	20	--.- ---.-	--	--	--
110000Z	16.5N 138.3E	65	16.3N 138.4E	75	13	10	17.7N 134.5E	100	130	30	19.3N 131.1E	110	288	10	21.1N 128.3E	120	482	40
110600Z	17.1N 136.8E	55	17.1N 136.8E	60	0	5	19.0N 131.8E	60	103	-20	21.2N 128.3E	60	283	-45	--.- ---.-	--	--	--
111200Z	16.8N 135.3E	60	17.4N 135.0E	45	46	-15	19.4N 131.0E	30	141	-60	21.3N 126.8E	45	292	-65	23.1N 123.0E	60	413	-15
111800Z	16.8N 133.8E	65	17.8N 134.6E	40	75	-25	19.9N 129.9E	40	173	-55	21.8N 125.7E	50	335	-45	--.- ---.-	--	--	--
120000Z	17.1N 132.3E	70	16.9N 132.2E	25	13	-45	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
120600Z	17.5N 130.9E	80	17.5N 131.0E	65	6	-15	19.7N 126.3E	80	143	-25	22.0N 122.4E	80	314	10	--.- ---.-	--	--	--
121200Z	17.6N 129.4E	90	17.9N 129.4E	70	18	-20	20.1N 124.4E	80	160	-30	22.3N 120.3E	80	295	5	24.8N 117.0E	30	358	-75
121800Z	17.7N 127.9E	95	18.5N 128.1E	70	49	-25	20.6N 123.3E	80	205	-15	23.0N 119.4E	75	326	-5	--.- ---.-	--	--	--
130000Z	17.7N 126.3E	100	17.8N 126.4E	95	8	-5	19.2N 120.0E	95	108	15	21.5N 115.7E	90	193	5	--.- ---.-	--	--	--
130600Z	17.7N 124.9E	105	17.7N 125.0E	100	6	-5	18.9N 119.1E	85	87	15	21.0N 114.0E	90	169	-10	--.- ---.-	--	--	--
131200Z	17.6N 123.4E	110	17.7N 123.4E	95	6	-15	19.4N 117.6E	85	111	10	21.8N 112.7E	80	206	-25	--.- ---.-	--	--	--
131800Z	17.4N 122.0E	95	17.7N 122.0E	85	18	-10	19.3N 116.7E	85	90	5	21.9N 112.4E	80	185	-35	--.- ---.-	--	--	--
140000Z	17.4N 120.7E	80	17.3N 120.8E	60	8	-20	19.3N 115.6E	75	69	-10	22.1N 111.6E	40	196	-80	--.- ---.-	--	--	--
140600Z	17.5N 119.5E	70	17.6N 119.7E	65	13	-5	19.6N 115.0E	80	69	-20	22.3N 111.3E	40	181	-75	--.- ---.-	--	--	--
141200Z	17.7N 118.4E	75	17.6N 118.7E	70	18	-5	18.6N 114.4E	85	45	-20	20.4N 111.0E	85	178	-25	--.- ---.-	--	--	--
141800Z	17.9N 117.3E	80	17.7N 117.5E	75	16	-5	19.1N 113.4E	85	66	-30	20.9N 110.3E	70	217	-20	--.- ---.-	--	--	--
150000Z	18.3N 116.2E	85	18.7N 116.0E	80	26	-5	21.0N 112.1E	80	137	-40	--.- ---.-	--	--	--	--.- ---.-	--	--	--
150600Z	18.6N 115.6E	100	18.6N 115.7E	75	6	-25	20.4N 112.3E	75	96	-40	--.- ---.-	--	--	--	--.- ---.-	--	--	--
151200Z	19.1N 115.0E	105	19.1N 114.7E	100	17	-5	21.1N 111.5E	90	140	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
151800Z	19.5N 114.5E	115	19.4N 114.5E	105	6	-10	21.4N 112.0E	90	118	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160000Z	20.0N 114.3E	120	20.0N 114.1E	100	11	-20	22.3N 112.5E	70	69	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160600Z	20.6N 114.0E	115	21.0N 113.9E	95	25	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161200Z	21.4N 114.0E	110	21.5N 113.9E	90	8	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161800Z	22.3N 113.9E	90	22.0N 113.9E	85	18	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170000Z	23.1N 113.4E	35	23.1N 113.1E	50	16	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	17NM	109NM	245NM	422NM	17NM	109NM	245NM	422NM
AVERAGE RIGHT ANGLE ERROR	13NM	83NM	152NM	222NM	13NM	83NM	152NM	222NM
AVERAGE MAGNITUDE OF WIND ERROR	13KTS	26KTS	30KTS	38KTS	13KTS	26KTS	30KTS	38KTS
AVERAGE BIAS OF WIND ERROR	-10KTS	-8KTS	-10KTS	-8KTS	-10KTS	-8KTS	-10KTS	-8KTS
NUMBER OF FORECASTS	29	24	18	4	29	24	18	4


BEST TRACK
TYPHOON SHIRLEY
12-17 AUG 1971
CYCLONE 22
MAX SFC WND - 90kts
MINIMUM SLP - 955mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
KURIL ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND

SHIRLEY

Forming from a disturbance caused by an upper-level circulation in the mid-Pacific trough, the first signs of Shirley's surface inducement came from the HAWAII BEAR on the 11th, which confirmed the existence of a circulation 300 n mi southwest of Marcus Island. Aircraft reconnaissance early on the 13th revealed the status of the system as a tropical storm with 55-kt winds and placed Shirley some 250 n mi southeast of Iwo Jima (Figure 5-33).

Situated in a weakness area in the subtropical ridge, the storm remained quasi-stationary for 12 hours before she shifted to a northerly course at 5 kt and acquired typhoon strength during the evening of the 13th.

Continuing on a northerly course along the western periphery of a high cell centered south of Ocean Station Victor, Shirley's forward movement gradually increased to 15 kt over the next four days (Figure 5-34). Maximum winds during her lifetime reached 90 kt on the 16th at a position 400 miles east-southeast of Tokyo.

As the westerlies began to take hold, she shifted course toward the northeast accelerating to 40 kt but retaining her intensity. Late on the 17th, Shirley transformed to extratropical characteristics east of Hokkaido.

Invaluable service was furnished by the Norweigen ship BONNEVILLE which responded to Fleet Weather Central Guam's request for three-hourly ship reports during the uncertain forecast period from the 12th to the 14th. Peak winds of 42 kt were experienced by the BONNEVILLE early in the morning of the 12th.

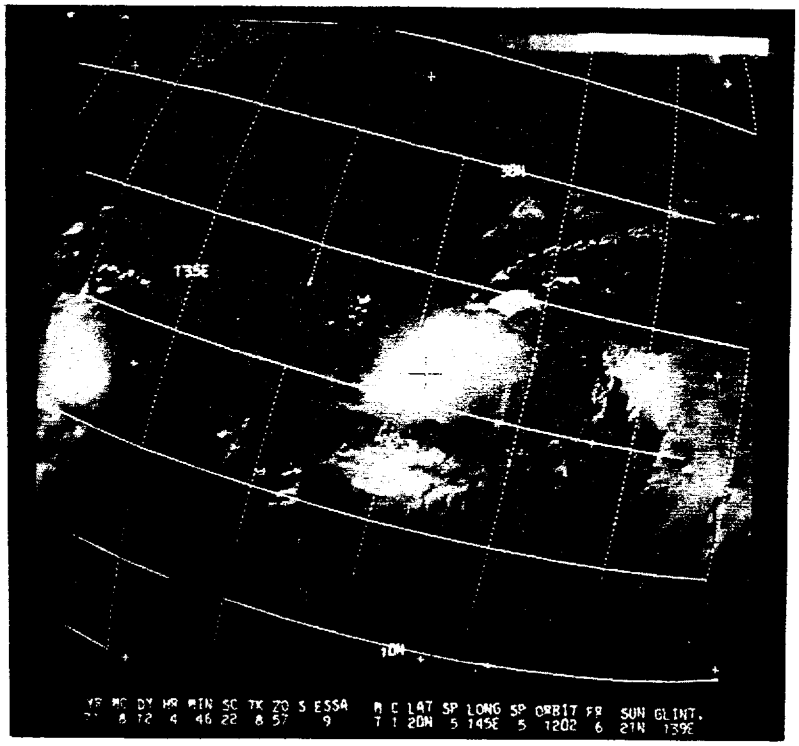


FIGURE 5-33. SHIRLEY AS A RECENTLY-DEVELOPED STORM BETWEEN MARCUS AND IWO JIMA ON 12 AUGUST. TROPICAL SYSTEM SEEN ON WESTERN PORTION OF ESSA-9 IS TYPHOON ROSE.

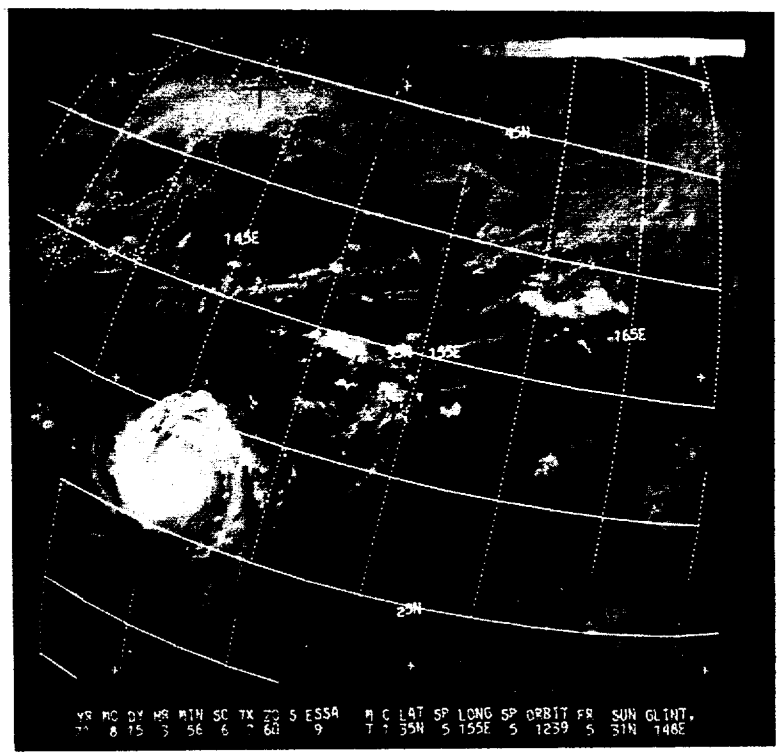


FIGURE 5-34. ESSA-9 SATELLITE VIEW OF TYPHOON SHIRLEY LOCATED EAST OF CHI CHI JIMA ISLAND ON 15 AUGUST.

TYPHOON SHIRLEY
EYE FIXES FOR CYCLONE NO. 22
12 AUG - 17 AUG 71

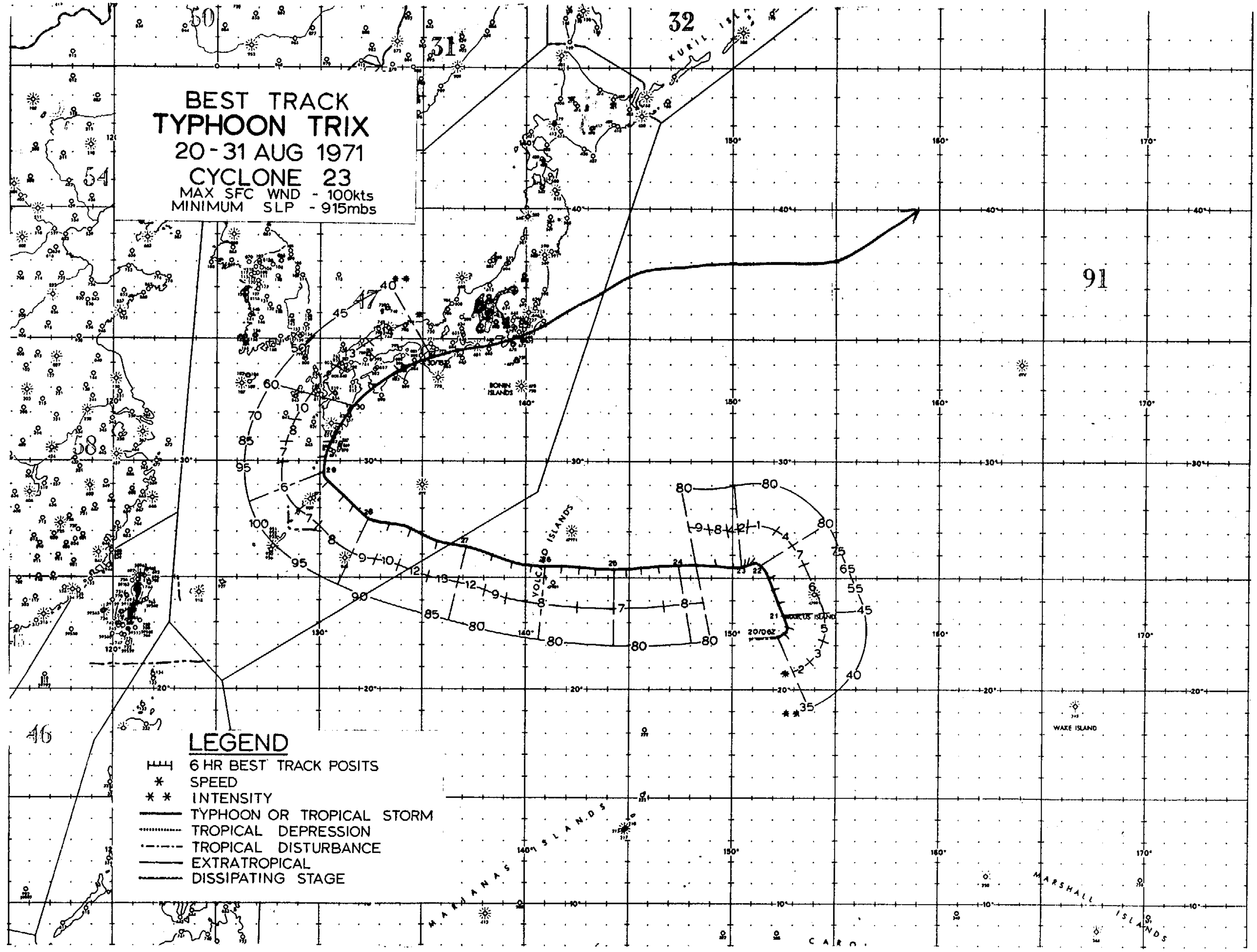
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	110348Z	17.5N 150.5E	SATELIT---	STG B										FIRST BLTN	
2	112330Z	22.0N 148.9E	54-P-30- 3	700MB	23	20	----	----	--/--	----	-----	--	--	CNTR DIA 15NM	
3	120446Z	21.5N 146.0E	SATELIT---	STG X	DIA	3	CAT 2.0							NO EYE VISIBLE	
4	130000Z	21.1N 144.1E	54-P-10---	700MB	20	25	1006	3097	12/10	----	-----	--	--	NO WC	
5	130100Z	22.6N 145.1E	54-P- 6- 6	700MB	45	75	992	3045	16/12	----	-----	10	--	WC S AND SW QUAD	
6	130350Z	23.0N 144.0E	SATELIT---	STG C+										LITTLE CHG	
7	130400Z	22.7N 144.8E	54-P- 3- 5	700MB	45	75	992	3021	16/12	----	-----	10	--	WC S AND SW	
8	131029Z	22.3N 144.8E	VQ-R- 5-15	-----	----	----	----	----	--/--	----	-----	35	8	WC OPEN NW	22.6N 145.6E
9	131120Z	22.8N 144.5E	VQ-R------	-----	----	----	----	----	--/--	----	-----	--	--		24.6N 145.0E
10	131550Z	23.3N 144.1E	VQ-P-10- 5	700MB	----	65	980	3008	15/12	----	-----	30	--	WC OPEN N	
11	132200Z	24.1N 144.2E	54-P- 5-10	700MB	50	70	984	2947	13/11	----	-----	30	--	WC OPEN NW	
12	140425Z	24.7N 144.9E	54-P- 5---	700MB	75	65	982	2908	10/08	----	-----	35	3	POORLY DEF - 700	
														CNTR 5NM W	
13	140448Z	25.0N 144.5E	SATELIT---	STG C+										LITTLE CHG	
14	141000Z	24.8N 145.0E	54-P- 3- 5	700MB	60	----	975	2890	14/11	----	-----	25	--	VERY POORLY DEF	
15	141545Z	25.7N 145.3E	54-P- 3- 3	700MB	65	----	974	2865	17/11	----	-----	10	2	WC OPEN NE	
16	142220Z	26.8N 145.1E	54-P-10---	700MB	----	65	969	2832	14/09	----	-----	30	--	CLSD WC	
17	150330Z	27.6N 145.1E	54-P-12---	700MB	50	60	966	2804	14/10	----	-----	10	--	CLSD WC	
18	150356Z	27.5N 145.5E	SATELIT---	STG X	DIA	2	CAT 3.5							SMALL EYE VSBL	
19	151146Z	28.7N 145.4E	VQ-R-10- 5	-----	----	----	----	----	--/--	----	-----	16	8	WC OPEN NE	27.1N 143.0E
20	151522Z	29.7N 145.8E	VQ-R-10- 5	-----	----	----	----	----	--/--	----	-----	17	--	WC OPEN SW-ROTATT	29.8N 144.8E
														NE 200 DEG/6HR	
21	152223Z	31.1N 145.4E	54-P- 6- 2	700MB	85	90	958	2725	13/11	----	-----	20	4	OPEN NW SEMIC	
														700 CNTR 7NM N	
22	160400Z	32.1N 145.9E	54-P- 2- 2	700MB	85	90	958	2743	15/11	----	-----	20	3	SAME AS 04Z RMK	
23	160455Z	32.5N 146.0E	SATELIT---	STG C+										LITTLE CHG	
24	161010Z	34.0N 146.4E	54-P-14---	700MB	40	----	966	2816	16/14	----	-----	60	--	700 WIND CNTR 15	
														NM N OF RDR CNTR	
25	161215Z	34.5N 147.3E	54-P------	700MB	45	----	----	----	--/--	----	-----	--	--	FL CNTR IS IN NE	
														QUAD OF RDR CNTR	
26	161600Z	35.8N 148.7E	54-P-20---	700MB	----	----	966	2813	15/15	----	-----	60	--	WC DISSIPATING	
27	162241Z	38.1N 149.9E	VQ-P-10- 5	700MB	----	100	961	2807	19/18	----	-----	16	7	WC OPEN W	
28	170400Z	40.8N 152.5E	54-P-10- 5	700MB	78	100	955	2679	16/--	----	-----	--	--	NO WC	
29	170402Z	41.0N 152.0E	SATELIT---	STG X	DIA	2	CAT 3.0							RAGGED EYE	
30	170700Z	42.5N 153.8E	54-P------	-----	----	----	----	----	--/--	----	-----	--	--	BASED ON CLD CIRC	

TYPHOON SHIRLEY

1200Z 12 AUG TO 0600Z 17 AUG

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
121200Z	22.2N 146.7E	45	22.0N 146.0E	45	41	0	22.7N 140.7E	60	200	-5	24.2N 135.8E	70	513	-5	25.6N 130.7E	75	802	-10
121800Z	22.3N 145.9E	50	22.0N 144.7E	45	69	-5	22.9N 139.4E	60	261	-10	24.4N 134.5E	70	591	-10	--.- ---.-	--	--	--
130000Z	22.5N 145.2E	55	22.5N 144.2E	55	55	0	23.0N 139.7E	70	260	0	24.2N 135.5E	75	552	-5	25.4N 131.4E	80	824	-10
130600Z	22.8N 144.7E	60	22.6N 144.5E	70	16	10	23.1N 140.8E	85	229	10	24.0N 136.6E	95	527	10	--.- ---.-	--	--	--
131200Z	23.1N 144.3E	65	22.8N 143.5E	70	48	5	23.3N 139.9E	80	310	5	24.3N 135.6E	90	591	5	25.4N 131.4E	100	967	15
131800Z	23.6N 144.1E	70	23.3N 144.2E	70	19	0	23.3N 143.2E	80	197	0	23.4N 138.9E	90	526	5	--.- ---.-	--	--	--
140000Z	24.1N 144.3E	70	24.1N 144.2E	65	5	-5	23.1N 144.0E	70	230	-10	23.0N 139.7E	75	594	-15	23.3N 135.3E	85	1174	-5
140600Z	24.5N 144.7E	75	24.6N 145.2E	65	28	-10	23.0N 143.7E	65	305	-20	23.0N 139.4E	75	683	-15	--.- ---.-	--	--	--
141200Z	25.2N 145.2E	75	24.8N 145.0E	65	26	-10	24.4N 144.5E	75	284	-10	24.0N 141.5E	85	687	0	--.- ---.-	--	--	--
141800Z	26.0N 145.3E	80	26.0N 145.4E	75	5	-5	28.4N 145.5E	85	102	0	31.8N 146.8E	85	283	0	--.- ---.-	--	--	--
150000Z	26.9N 145.3E	80	27.1N 145.3E	80	12	0	30.1N 145.0E	75	87	-15	33.3N 148.4E	45	311	-45	--.- ---.-	--	--	--
150600Z	27.9N 145.3E	85	28.0N 145.1E	80	12	-5	31.7N 145.3E	60	78	-30	34.2N 151.7E	35	446	-55	--.- ---.-	--	--	--
151200Z	29.1N 145.3E	85	28.8N 145.3E	75	18	-10	32.2N 146.1E	55	143	-30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
151800Z	30.1N 145.3E	85	29.9N 145.5E	70	16	-15	33.9N 148.0E	50	146	-35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160000Z	31.9N 145.5E	90	31.5N 145.5E	85	0	-5	35.6N 151.0E	55	166	-35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
160600Z	32.9N 145.9E	90	32.5N 146.2E	85	28	-5	36.2N 152.3E	50	124	-40	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161200Z	34.9N 146.9E	85	33.3N 146.9E	70	72	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
161800Z	36.3N 148.6E	85	36.2N 149.6E	65	49	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170000Z	38.3N 150.2E	90	38.7N 150.1E	80	24	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
170600Z	41.6N 153.0E	90	4 .0N 153.4E	85	30	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	29NM	208NM	525NM	942NM	29NM	208NM	525NM	942NM
AVERAGE RIGHT ANGLE ERROR	18NM	112NM	321NM	672NM	18NM	112NM	321NM	672NM
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	16KTS	14KTS	10KTS	7KTS	16KTS	14KTS	10KTS
AVERAGE BIAS OF WIND ERROR	-6KTS	-14KTS	-11KTS	-3KTS	-6KTS	-14KTS	-11KTS	-3KTS
NUMBER OF FORECASTS	20	16	12	4	20	16	12	4


BEST TRACK
TYPHOON TRIX
20 - 31 AUG 1971
CYCLONE 23
MAX SFC WND - 100kts
MINIMUM SLP - 915mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
KURIL ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
MARSHALL ISLANDS

TRIX

A disturbance created by an upper-level circulation in the mid-Pacific trough gave birth to a surface circulation, later to be Trix, some 200 n mi southwest of Marcus Island on the 19th. By the following day, winds of tropical-storm force were being generated in the system.

A stationary short-wave trough in the westerlies over the Kuril Islands had broken down the subtropical ridge in the general longitude of the typhoon, thus providing little steering current to Trix. The storm drifted northward at 6-7 kt (Figure 5-35) attaining typhoon-force strength the night of the 21st 100 n mi west of Marcus Island.

On the 22nd the storm remained nearly stationary for 24 hours, then in response to strengthening of the ridge, Trix began a westward track on a heading that took her near Iwo Jima on the morning of the 26th. Winds of 35 kt with gusts to 45 kt were recorded on the island as the typhoon passed 40 n mi to the north.

The storm then took aim for the northern Ryukyus and began a slow intensification on the 27th. Prior to recurvature, Trix slowed to 8 kt (Figure 5-36) and her central pressure began to plummet some 30 mb in 24 hours--an unusual phenomena for a typhoon at such a relatively high latitude. About 30 miles south of Yaku-Shima Island aircraft reconnaissance measured a minimum pressure of 915 mb within a tight 8 n mi eye. In spite of the abnormally low pressure, maximum sustained winds did not appear to exceed the 100-kt level as determined by aircraft. Maximum-observed wind in the Ryukyus was reported by Yaku-Shima station with 66 kt gusting to 96 kt as the center of Trix passed 20 n mi to its west.

Following three weeks after Olive, Trix struck Kyushu at Cape Sata in the early morning of the 30th. She then paralleled the Japan coast line emerging from the Boso Peninsula as an extratropical system. The typhoon brought torrential rains to the Japanese islands with as much as 43 inches recorded in the mountainous terrain of Kyushu (Yangitake, Miyazaki prefecture). The huge rainfall flooded many rivers and streams and caused numerous landslides. In addition the weather halted the National Railways in Kyushu and paralyzed the nation's air and surface transport systems.

Fourty-four deaths were reported, over 1,000 dwellings were partially or completely destroyed and over 120,000 homes were flooded. A total of 50.6 million dollars (U.S.) was lost in damages sustained to the rice, fruit and vegetable crops. In addition, a series of tornadoes swept through the coastal part of Chiba City accounting for one death as the weakened extratropical stages of Trix passed back out to sea.

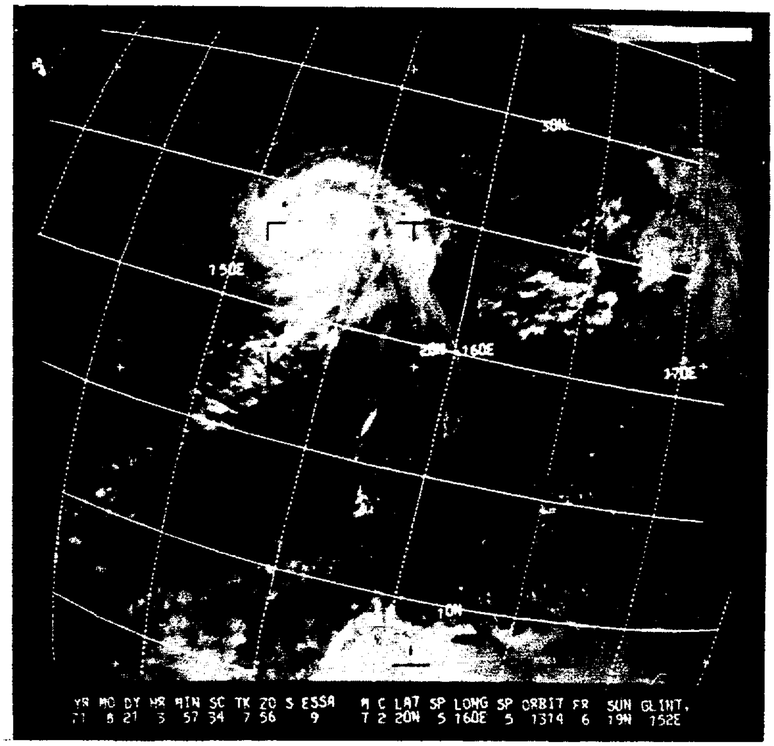


FIGURE 5-35. TRIX AS SIGHTED BY ESSA-9 WHILE A TROPICAL STORM JUST WEST OF MARCUS ISLAND ON 21 AUGUST.

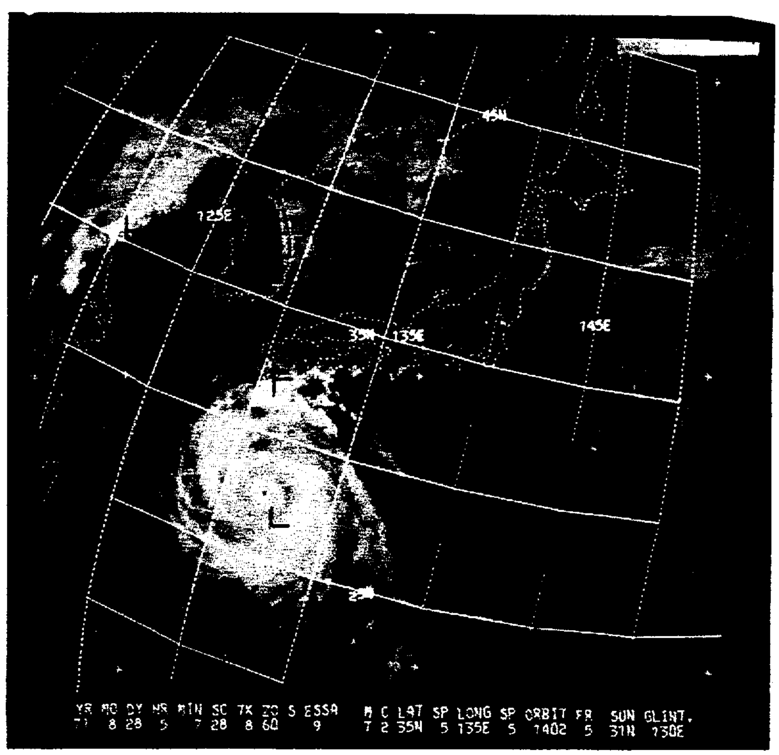


FIGURE 5-36. ESSA-9 PHOTO OF TYPHOON TRIX EAST OF THE RYUKYU CHAIN ON 28 AUGUST.

TYPHOON TRIX
EYE FIXES FOR CYCLONE NO. 23
20 AUG - 31 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	200250Z	22.4N 152.1E	54-P- 7- 2	700MB	38	35	996	3042	12/10	CIRC		20	--	SPIRALING SC	
2	200454Z	22.5N 152.5E	SATELIT---	STG C										COMMA SHAPED CLD	
3	202120Z	23.1N 152.7E	54-P-12---	700MB	30	40	992	3002	11/09	----	-----	--	--	VISUAL SFC CNTR	
4	202200Z	23.1N 152.6E	54-P-12---	700MB	30	40	994	3000	11/09	----	-----	--	--	VISUAL SFC CNTR	
5	210330Z	23.6N 152.2E	54-P-11---	700MB	33	45	987	2984	13/10	----	-----	--	--	WC FORMING-700 CNTR 3NM NW	
6	210358Z	23.5N 152.0E	SATELIT---	STG C										BETTER ORGANIZED	
7	211020Z	24.3N 152.0E	VQ-P- 3---	-----	----	45	985	----	26/23	ELIP	SE-NW	35X30	--	WC FORMING	
8	211528Z	24.7N 152.0E	VQ-P- 3---	-----	----	65	978	----	27/23	CIRC		30	10	WC OPEN N	
9	220200Z	25.5N 151.1E	54-P- 5---	700MB	65	70	970	2841	14/12	CIRC		30	--	WC OPEN NW-SFC CNTR 10NM SW	
10	220410Z	25.6N 151.0E	54-P- 3---	700MB	70	60	970	2841	17/13	ELIP	NE-SW	25X10	--	WC WEAKENING	
11	220456Z	25.5N 151.5E	SATELIT---	STG X	DIA	2	CAT 3.0							SMALL EYE VISIBLE	
12	221930Z	25.5N 150.6E	54-P- 5---	700MB	66	70	967	2813	15/10	CIRC		20	--	WC OPEN W	
13	222248Z	25.8N 150.7E	54-P------	700MB	----	----	----	2792	14/--	----	-----	--	--		
14	230210Z	25.3N 150.4E	54-P-10---	700MB	70	75	963	2780	14/10	ELIP	NE-SW	35X20	--	CLSD WC	
15	230404Z	25.5N 150.0E	SATELIT---	STG X	DIA	2	CAT 3.5							SMALL EYE VISIBLE	
16	231105Z	25.5N 149.1E	VQ-R- 8- 7	-----	----	----	----	----	--/--	ELIP	E-W	40X34	9	CLSD WC	26.0N 150.0E
17	231545Z	25.3N 148.4E	VQ-P- 6- 2	700MB	----	80	967	2819	25/22	CIRC		30	--	WC OPEN N	
18	232145Z	25.4N 147.6E	54-P- 5- 5	700MB	60	----	962	2771	15/11	CIRC		25	--	WEAK RDR PRES	
19	240320Z	25.4N 146.8E	54-P-10- 2	700MB	75	65	961	2762	16/13	CIRC		30	--	CLSD WC	
20	240458Z	25.5N 146.5E	SATELIT---	STG X	DIA	2	CAT 2.5								
21	241545Z	25.3N 145.3E	VQ-P- 3- 3	700MB	----	----	964	2795	13/09	CIRC		32	10	CLSD WC	
22	242200Z	25.2N 144.4E	54-P- 5---	700MB	65	----	959	2726	14/12	CIRC		30	--	CLSD WC-FL CNTR	
23	250406Z	25.0N 144.0E	SATELIT---	STG X	DIA	2	CAT 3.5							EYE VISIBLE	
24	250410Z	25.2N 143.9E	54-P- 5- 3	700MB	85	80	962	2765	16/10	CIRC		30	--	CLSD WC	
25	250938Z	25.8N 143.1E	VQ-R- 5- 5	-----	----	----	----	----	--/--	CIRC		17	6	POOR RDR PRES	25.7N 144.2E
26	251555Z	25.6N 142.1E	VQ-P- 2- 4	700MB	----	----	955	2804	18/14	CIRC		22	--	HOLE IN SEA RETRN	
27	252200Z	25.4N 141.2E	54-P- 2- 2	700MB	43	75	963	2752	13/12	CIRC		15	3	WC OPEN W SEMIC-700 CNTR 1NM S	
28	260300Z	25.4N 140.5E	54-P- 4- 2	700MB	69	55	961	2749	13/10	----	-----	--	--	BCMG DISORG	
29	260500Z	25.5N 140.2E	SATELIT---	STG X	DIA	2	CAT 3.0							EYE FAINTLY VSBL	
30	260950Z	25.6N 139.7E	VQ-R- 2---	-----	----	----	----	----	--/--	CIRC		15	10	WC OPEN N SEMIC	26.1N 139.5E
31	261520Z	25.7N 138.6E	VQ-P- 3---	700MB	----	----	967	2782	14/10	CIRC		12	8	WC OPEN NW SEMIC	
32	262155Z	26.2N 137.7E	54-P- 2-13	700MB	40	70	966	2783	15/13	CIRC		20	3	POORLY DEFINED-700 CNTR 5NM S	
33	262345Z	26.2N 137.6E	54-P------	700MB	----	----	----	2865	13/--	----	-----	--	--		
34	270206Z	26.5N 136.5E	54-P- 2-13	700MB	60	90	960	2752	14/14	CIRC		10	5	POORLY DEFINED	
35	270310Z	26.5N 136.3E	54-P- 2-18	700MB	60	90	962	2752	14/13	CIRC		10	5	POORLY DEFINED	
36	270559Z	26.5N 136.0E	SATELIT---	STG X	DIA	2	CAT 3.5							EYE VSBL LTL CHG 700MB FIX	
37	270933Z	26.7N 135.3E	VQ-R- 5---	-----	----	----	----	----	--/--	CIRC		12	8	CLSD WC	26.5N 134.6E
38	271537Z	27.3N 133.8E	VQ-P- 5---	700MB	----	----	955	2697	17/13	ELIP	N-S	14X11	10	CLSD WC	
39	272130Z	27.5N 132.6E	VQ-R- 8---	-----	----	----	----	----	--/--	CIRC		13	10	WC OPEN NE QUAD	28.2N 132.1E
40	272200Z	27.5N 132.6E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
41	272300Z	27.5N 132.5E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
42	280000Z	27.6N 132.4E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
43	280100Z	27.6N 132.3E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
44	280100Z	27.6N 131.8E	LND RDR---							----	-----	--	--	OKINAWA RDR	
45	280125Z	27.7N 132.2E	VQ-P- 5---	700MB	----	----	953	2694	16/10	CIRC		18	8	WC OPEN NE QUAD	

TYPHOON TRIX
EYE FIXES FOR CYCLONE NO. 23
20 AUG - 31 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
46	280200Z	27.6N 132.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
47	280300Z	27.7N 132.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
48	280357Z	27.9N 131.9E	VQ-P- 3---	700MB	----	----	953	2690	15/12	CIRC		20	8	CLSD WC	
49	280400Z	27.8N 132.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
50	280400Z	27.7N 131.6E	LND RDR---							----	-----	--	--	OKINAWA RDR	
51	280500Z	27.9N 131.9E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
52	280500Z	27.8N 131.6E	LND RDR---							----	-----	--	--	OKINAWA RDR	
53	280507Z	27.5N 132.0E	SATELIT---	STG X	DIA	2 CAT	3.5							EYE VSBL LTL CHG	
54	280600Z	28.0N 131.8E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
55	280600Z	28.1N 131.7E	LND RDR---							----	-----	--	--	OKINAWA RDR	
56	280700Z	28.1N 131.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
57	280700Z	28.1N 131.7E	LND RDR---							----	-----	--	--	OKINAWA RDR	
58	280700Z	28.3N 131.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
59	280717Z	28.2N 131.6E	54-P- 1-14	700MB	32	85	942	2591	16/12	CIRC		25	5	CLSD WC-700 CNTR ON WEDGE OF WC	
60	280800Z	28.3N 131.6E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
61	280800Z	28.2N 131.6E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
62	280800Z	28.4N 131.6E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
63	280800Z	28.2N 131.8E	LND RDR---							----	-----	--	--	OKINAWA RDR	
64	280900Z	28.4N 131.6E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
65	280900Z	28.5N 131.6E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
66	280900Z	28.2N 131.7E	LND RDR---							----	-----	--	--	OKINAWA RDR	
67	280937Z	28.4N 131.4E	54-P- 1- 9	700MB	40	80	941	2566	17/14	CIRC		20	5	WC OPEN SE	
68	281000Z	28.5N 131.4E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
69	281000Z	28.2N 131.3E	LND RDR---							----	-----	--	--	OKINAWA RDR	
70	281000Z	28.7N 131.4E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
71	281000Z	28.5N 131.4E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
72	281100Z	28.7N 131.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
73	281100Z	28.6N 131.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
74	281100Z	28.8N 131.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
75	281200Z	28.7N 131.1E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
76	281200Z	28.9N 131.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
77	281200Z	28.8N 131.1E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
78	281300Z	28.8N 131.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
79	281300Z	28.8N 131.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
80	281300Z	29.0N 131.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
81	281300Z	28.8N 131.0E	54-P- 1- 9	700MB	75	----	927	2536	18/15	CIRC		20	5	CLSD WC-FL FIX	
82	281400Z	29.0N 130.8E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
83	281400Z	29.1N 130.8E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
84	281400Z	28.9N 130.8E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
85	281500Z	29.2N 130.6E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
86	281500Z	29.0N 130.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
87	281510Z	29.0N 130.6E	54-P- 1- 9	700MB	65	----	936	2539	19/16	CIRC		20	5	CLSD WC-FL FIX	
88	281600Z	29.1N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
89	281800Z	29.3N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
90	281800Z	29.3N 130.3E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
91	281800Z	29.3N 130.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
92	281900Z	29.3N 130.2E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
93	281900Z	29.4N 130.2E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
94	281900Z	29.3N 130.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E

TYPHOON TRIX
EYE FIXES FOR CYCLUNE NO. 23

20 AUG - 31 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
95	281920Z	29.6N 130.3E	54-P- 5- 5	700MB	90	----	921	2414	24/13	CIRC		10	5	CLSD WC	
96	282010Z	29.4N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
97	282100Z	29.4N 130.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
98	282110Z	29.4N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
99	282200Z	29.5N 130.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
100	282200Z	29.4N 130.0E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
101	282210Z	29.4N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
102	282200Z	29.5N 129.7E	54-P- 5- 5	700MB	105	65	916	2359	21/14	CIRC		10	5	CLSD WC	
103	282300Z	29.5N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
104	282300Z	29.5N 130.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
105	282300Z	29.5N 130.1E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
106	290002Z	29.5N 130.1E	54-P- 5- 5	700MB	97	90	914	2377	22/14	CIRC		10	5	CLSD WC	
107	290010Z	29.6N 130.0E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
108	290100Z	29.6N 130.1E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
109	290100Z	29.6N 130.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
110	290105Z	29.6N 130.1E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
111	290200Z	29.7N 130.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
112	290200Z	29.8N 130.2E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
113	290210Z	29.7N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
114	290340Z	29.8N 130.2E	VQ-P- 5---	700MB	----	75	915	2402	21/14	CIRC		11	3	CLSD WC	
115	290400Z	29.9N 130.2E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
116	290400Z	29.9N 130.3E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
117	290400Z	30.0N 130.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
118	290430Z	29.9N 130.2E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
119	290600Z	30.2N 130.2E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
120	290600Z	30.3N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
121	290606Z	30.2N 130.2E	SATELIT---	STG X	DIA	2	CAT 4.0							EYE VISIBLE	
122	290642Z	30.2N 130.1E	VQ-P- 1---	700MB	----	75	916	2408	23/13	CIRC		11	6	CLSD WC	
123	290900Z	30.5N 130.2E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
124	290900Z	30.6N 130.4E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
125	290900Z	30.6N 130.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
126	290925Z	30.5N 130.2E	VQ-P- 1---	700MB	----	65	918	2499	21/14	CIRC		8	5	CLSD WC	
127	291000Z	30.6N 130.3E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
128	291000Z	30.6N 130.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
129	291000Z	30.6N 130.4E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
130	291000Z	30.6N 130.2E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
131	291200Z	30.7N 130.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
132	291200Z	30.6N 130.3E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
133	291200Z	30.7N 130.5E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
134	291200Z	30.7N 130.5E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
135	291255Z	30.8N 130.5E	VQ-R- 3---	----	----	----	----	----	--/--	CIRC		10	5	CLSD WC	30.7N 129.9E
136	291300Z	30.8N 130.6E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
137	291300Z	30.7N 130.4E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
138	291300Z	30.7N 130.6E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
139	291400Z	30.9N 130.7E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
140	291400Z	30.9N 130.7E	LND RDR---							----	-----	--	--	STN 47909	28.4N 129.5E
141	291500Z	31.1N 130.8E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
142	291500Z	31.1N 130.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
143	291500Z	31.1N 130.8E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
144	291600Z	31.2N 130.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E

TYPHOON TRIX
EYE FIXES FOR CYCLONE NO. 23
20 AUG - 31 AUG 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
145	291600Z	31.2N 130.9E	VQ-R- 5---	-----	----	----	----	----	--/--	CIRC		12	--	WC OPEN W SEMIC	30.9N 130.2E
146	291600Z	31.2N 130.8E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
147	291700Z	31.3N 130.9E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
148	291700Z	31.3N 130.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
149	291700Z	31.3N 130.7E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
150	291800Z	31.4N 130.9E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
151	291800Z	31.4N 130.9E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
152	291850Z	31.5N 131.0E	VQ-R- 8---	-----	----	----	----	----	--/--	CIRC		15	--	WK WC E SEMIC	30.8N 130.5E
153	291900Z	31.5N 131.0E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
154	291900Z	31.6N 131.0E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
155	292000Z	31.6N 131.2E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
156	292000Z	31.7N 131.1E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
157	292100Z	31.8N 131.4E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
158	292100Z	31.8N 131.2E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
159	292100Z	31.8N 131.5E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
160	292200Z	32.0N 131.4E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
161	292200Z	31.9N 131.3E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
162	292210Z	32.0N 131.0E	LND RDR---							----	-----	--	--	STN 47854	32.1N 131.4E
163	292210Z	32.1N 131.4E	54-P- 0-10	500MB	45	----	----	2830	02/00	CIRC		25	--	POORLY DEFINED	
164	292300Z	32.3N 131.6E	LND RDR---							----	-----	--	--	STN RJFF	33.6N 130.4E
165	292300Z	32.1N 131.2E	LND RDR---							----	-----	--	--	STN 47869	30.6N 131.0E
166	292300Z	32.1N 131.5E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
167	300100Z	32.2N 131.7E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
168	300115Z	32.5N 131.7E	54-P-10---	500MB	35	----	----	2840	00/01	CIRC		25	5	POORLY DEFINED	
169	300200Z	32.3N 131.6E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
170	300200Z	32.3N 131.9E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
171	300300Z	32.4N 132.1E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
172	300313Z	32.8N 131.9E	54-P- 1- 9	500MB	35	----	----	2820	01/01	CIRC		30	--	POORLY DEFINED	
173	300400Z	32.4N 132.1E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
174	300400Z	32.5N 132.4E	LND RDR---							----	-----	--	--	STN 47806	33.4N 130.3E
175	300425Z	32.4N 132.5E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
176	300500Z	32.5N 132.7E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
177	300509Z	33.0N 132.0E	SATELII---	STR C.										WEAKER	
178	300700Z	32.9N 133.2E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
179	300800Z	33.0N 133.7E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
180	300800Z	33.0N 133.4E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
181	300900Z	33.2N 133.8E	LND RDR---							----	-----	--	--	STN 47773	34.6N 135.7E
182	300900Z	33.2N 133.7E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
183	300900Z	32.5N 133.7E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
184	301000Z	33.5N 133.8E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
185	301000Z	34.1N 133.1E	54-P- 3---	500MB	42	----	----	2660	01/02	----	-----	--	--	500MB WIND CNTR	
186	301000Z	33.5N 133.9E	LND RDR---							----	-----	--	--	STN 47773	34.6N 135.7E
187	301000Z	33.4N 133.8E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
188	301100Z	33.6N 133.7E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
189	301100Z	33.6N 133.9E	LND RDR---							----	-----	--	--	STN 47773	34.6N 135.7E
190	301100Z	33.8N 133.9E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
191	301200Z	33.8N 133.8E	LND RDR---							----	-----	--	--	STN 47899	33.2N 134.2E
192	301200Z	33.7N 133.9E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
193	301200Z	33.6N 133.9E	LND RDR---							----	-----	--	--	STN 47773	34.6N 135.7E
194	301200Z	33.8N 133.9E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E

TYPHOON TRIX
EYE FIXES FOR CYCLONE NO. 23
20 AUG - 31 AUG 71

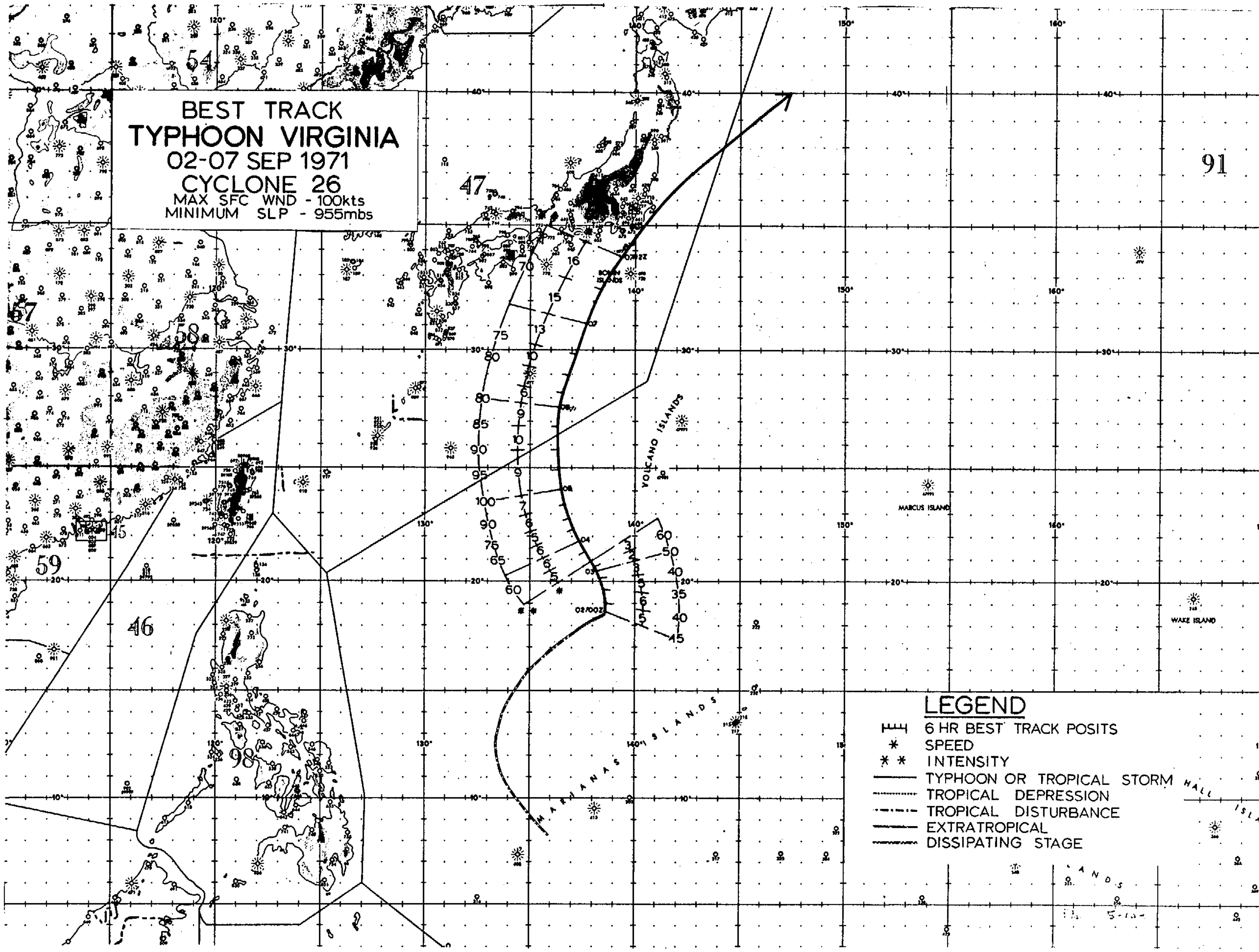
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
195	301300Z	34.0N 134.1E	LND RDR---							----	-----	--	--	STN 47899	33.2N 139.2E
196	301300Z	33.9N 134.2E	LND RDR---							----	-----	--	--	STN 47773	34.6N 132.7E
197	301300Z	33.9N 134.1E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
198	301300Z	34.0N 134.1E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
199	301300Z	33.9N 134.1E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
200	301400Z	34.1N 134.4E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
201	301400Z	34.0N 134.4E	LND RDR---							----	-----	--	--	STN 47773	34.6N 132.7E
202	301400Z	34.1N 134.4E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
203	301500Z	34.2N 134.6E	LND RDR---							----	-----	--	--	STN 47773	34.6N 132.7E
204	301500Z	34.1N 134.6E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
205	301500Z	34.2N 134.6E	LND RDR---							----	-----	--	--	STN 47791	35.5N 133.1E
206	301500Z	34.2N 134.4E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.6E
207	301500Z	34.2N 134.5E	LND RDR---							----	-----	--	--	STN 47899	33.2N 139.2E
208	301600Z	34.4N 134.5E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
209	301600Z	34.6N 134.3E	54-P- 5---	500MB	25	----	----	2675	01/02	----	-----	--	--	POORLY DEFINED	
210	301600Z	34.5N 134.7E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.8E
211	301600Z	34.5N 134.7E	LND RDR---							----	-----	--	--	STN 47773	34.6N 132.7E
212	301700Z	34.5N 134.6E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E
213	301700Z	34.7N 134.9E	LND RDR---							----	-----	--	--	STN 47792	34.3N 132.8E
214	301800Z	34.7N 134.9E	LND RDR---							----	-----	--	--	STN 47773	34.6N 132.7E
215	301800Z	34.8N 134.8E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.8E
216	302000Z	34.3N 135.0E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
217	302100Z	34.4N 135.3E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E
218	302100Z	34.5N 135.0E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
219	302226Z	34.6N 135.4E	VQ-R- 5-10	-----	----	----	----	----	--/--	CIRC		8	--	POORLY DEFINED	33.1N 132.4E
220	310100Z	34.3N 136.9E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E
221	310200Z	34.4N 137.2E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E
222	310300Z	34.5N 137.6E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E
223	310400Z	34.7N 138.0E	LND RDR---							----	-----	--	--	STN 47636	35.2N 137.0E

TYPHOON TRIX

0600Z 20 AUG TO 0600Z 31 AUG

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORFCAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
200600Z	22.5N 152.2E	35	22.4N 152.2E	30	6	-5	22.8N 151.8E	35	69	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201200Z	22.6N 152.4E	40	22.4N 152.2E	30	16	-10	22.9N 151.7E	35	91	-30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
201800Z	22.8N 152.6E	40	22.4N 152.2E	30	33	-10	23.0N 150.5E	45	139	-30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
210000Z	23.3N 152.6E	45	23.3N 152.6E	40	0	-5	24.8N 152.2E	50	64	-30	26.9N 150.6E	55	90	-25	29.2N 148.7E	60	237	-20
210600Z	23.9N 152.2E	55	23.9N 152.1E	45	5	-10	25.8N 149.9E	55	55	-25	27.7N 147.0E	65	219	-15	--.- ---.-	--	--	--
211200Z	24.4N 152.0E	65	24.3N 151.8E	45	12	-20	26.5N 150.3E	55	60	-25	28.7N 148.3E	65	203	-15	32.3N 147.6E	65	430	-15
211800Z	25.0N 151.8E	75	24.9N 151.8E	60	6	-15	26.9N 150.7E	80	78	0	29.5N 149.6E	85	256	5	--.- ---.-	--	--	--
220000Z	25.5N 151.3E	80	25.5N 150.9E	60	22	-20	27.5N 149.1E	70	146	-10	29.9N 147.5E	80	269	0	35.4N 150.2E	45	683	-35
220600Z	25.6N 150.9E	80	25.8N 150.9E	70	12	-10	27.6N 149.1E	80	147	0	29.6N 147.6E	80	258	0	--.- ---.-	--	--	--
221200Z	25.6N 150.8E	80	25.7N 151.0E	75	12	-5	26.0N 150.2E	85	65	5	27.1N 147.8E	90	156	10	30.0N 146.0E	90	325	10
221800Z	25.6N 150.7E	80	25.7N 151.0E	80	17	0	26.3N 149.7E	90	97	10	27.4N 147.4E	90	183	10	--.- ---.-	--	--	--
230000Z	25.4N 150.5E	80	25.8N 150.7E	80	26	0	27.4N 149.3E	90	157	10	29.4N 147.9E	90	319	10	32.3N 147.6E	75	533	-5
230600Z	25.3N 150.1E	80	25.6N 150.7E	80	37	0	26.3N 150.2E	80	206	0	27.2N 149.5E	80	346	0	--.- ---.-	--	--	--
231200Z	25.4N 149.2E	80	25.5N 149.0E	80	12	0	25.6N 144.8E	90	52	10	27.2N 141.6E	95	123	15	29.3N 139.5E	95	215	15
231800Z	25.4N 148.2E	80	25.2N 148.0E	80	16	0	25.9N 143.9E	90	65	10	27.7N 141.0E	95	138	15	--.- ---.-	--	--	--
240000Z	25.4N 147.4E	80	25.6N 147.4E	80	12	0	25.8N 144.4E	85	37	5	26.5N 141.4E	85	63	5	27.9N 138.7E	90	119	5
240600Z	25.4N 146.5E	80	25.4N 146.4E	80	5	0	25.4N 142.8E	85	33	5	25.5N 139.3E	90	43	10	--.- ---.-	--	--	--
241200Z	25.3N 145.7E	80	25.3N 145.4E	80	16	0	25.4N 141.7E	85	54	5	25.6N 138.1E	90	65	10	26.3N 134.7E	90	49	0
241800Z	25.3N 144.9E	80	25.3N 145.0E	80	5	0	25.4N 141.5E	85	17	5	25.6N 137.9E	90	32	10	--.- ---.-	--	--	--
250000Z	25.2N 144.2E	80	25.2N 144.1E	85	5	5	25.2N 140.5E	85	32	5	25.6N 136.9E	90	55	5	26.5N 133.5E	90	88	0
250600Z	25.3N 143.4E	80	25.2N 143.7E	85	17	5	25.2N 140.4E	90	24	10	25.6N 136.9E	95	92	10	--.- ---.-	--	--	--
251200Z	25.4N 142.7E	80	25.2N 142.9E	85	16	5	25.3N 139.6E	95	29	15	25.7N 136.2E	100	124	10	26.6N 133.2E	100	168	5
251800Z	25.5N 141.8E	80	25.5N 141.8E	85	0	5	25.5N 138.3E	95	30	15	26.1N 134.8E	100	104	10	--.- ---.-	--	--	--
260000Z	25.5N 141.0E	80	25.4N 140.8E	80	12	0	25.8N 137.0E	85	42	0	26.4N 133.6E	90	96	0	27.3N 130.2E	95	137	-5
260600Z	25.5N 140.1E	80	25.5N 140.0E	80	5	0	25.8N 136.5E	85	69	0	26.5N 133.1E	85	121	-10	--.- ---.-	--	--	--
261200Z	25.7N 139.3E	80	25.6N 139.2E	80	8	0	26.0N 135.7E	85	92	-5	26.7N 132.3E	90	135	-5	27.8N 129.1E	90	186	5
261800Z	26.0N 138.3E	80	25.6N 138.2E	80	24	0	26.3N 134.8E	85	96	-5	26.9N 131.3E	90	144	-10	--.- ---.-	--	--	--
270000Z	26.5N 137.1E	85	26.0N 137.3E	75	32	-10	27.4N 134.0E	70	86	-20	29.3N 131.1E	70	55	-30	31.6N 129.3E	65	122	5
270600Z	26.7N 135.7E	85	26.7N 135.9E	80	11	-5	28.3N 132.5E	75	44	-20	30.4N 130.1E	70	19	-25	--.- ---.-	--	--	--
271200Z	27.1N 134.5E	90	26.9N 135.0E	80	29	-10	28.7N 132.0E	75	47	-20	30.7N 129.9E	70	26	-15	33.8N 129.0E	65	243	20
271800Z	27.3N 133.4E	90	27.5N 133.5E	80	13	-10	29.8N 130.1E	75	41	-25	32.8N 129.0E	70	131	0	--.- ---.-	--	--	--
280000Z	27.6N 132.4E	90	27.8N 132.2E	85	16	-5	30.1N 128.5E	75	88	-25	32.7N 127.4E	65	214	5	--.- ---.-	--	--	--
280600Z	28.1N 131.7E	95	28.1N 131.7E	85	0	-10	30.2N 129.2E	75	52	-20	32.7N 128.3E	65	217	15	--.- ---.-	--	--	--
281200Z	28.7N 131.1E	95	28.7N 131.2E	80	5	-15	31.0N 129.2E	70	64	-15	34.4N 129.4E	60	225	15	--.- ---.-	--	--	--
281800Z	29.2N 130.5E	100	29.3N 130.4E	80	8	-20	32.0N 129.0E	70	108	0	36.0N 130.8E	55	249	15	--.- ---.-	--	--	--
290000Z	29.6N 130.1E	100	29.7N 129.6E	95	27	-5	32.4N 129.0E	75	132	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290600Z	30.1N 130.2E	95	30.0N 129.9E	90	17	-5	32.0N 129.4E	70	174	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	30.7N 130.4E	85	30.8N 130.2E	90	12	5	33.2N 130.3E	70	183	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291800Z	31.4N 131.0E	70	31.4N 130.9E	80	5	10	34.3N 132.0E	60	168	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300000Z	32.2N 131.6E	60	32.5N 131.7E	70	19	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300600Z	33.1N 132.6E	50	33.3N 132.3E	65	19	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301200Z	33.8N 133.9E	45	33.7N 134.3E	55	21	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301800Z	34.2N 135.4E	40	34.7N 135.2E	50	31	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORFCAST ERROR	15NM	83NM	149NM	253NM	15NM	83NM	149NM	253NM
AVERAGE RIGHT ANGLE ERROR	9NM	51NM	107NM	200NM	9NM	51NM	107NM	200NM
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	13KTS	10KTS	10KTS	7KTS	13KTS	10KTS	10KTS
AVERAGE BIAS OF WIND ERROR	-3KTS	-3KTS	1KTS	-1KTS	-3KTS	-3KTS	1KTS	-1KTS
NUMBER OF FORECASTS	43	39	32	14	43	39	32	14


BEST TRACK
TYPHOON VIRGINIA
02-07 SEP 1971
CYCLONE 26
MAX SFC WND - 100kts
MINIMUM SLP - 955mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARIANAS ISLANDS
MARCUS ISLAND
WAKE ISLAND
BONIN ISLANDS
02/00Z

VIRGINIA

Aircraft reconnaissance located newly formed tropical storm Virginia some 500 n mi northwest of Guam on the afternoon of September 1st. Early signs of the system can be traced back on synoptic charts to a circulation which had its origin near the Palau Islands on August 30th. Drifting north and then northeast, satellite pictures showed increasing character to the cloudiness of the system before reconnaissance investigation.

Located between two high cells, the storm began to drift slowly northward under the influence of the eastern cell (Figure 5-37) and intensified to typhoon strength by the afternoon of the 4th. As Virginia passed 270 n mi west of Iwo Jima, central winds peaked at 100 kt. Rounding the periphery of the high cell centered north of Marcus Island (Figure 5-38), the typhoon shifted to a north-northeast course during the afternoon of the 6th. On this heading, Virginia's center skirted the Boso Peninsula of Japan during the night of September 7th. As she merged with a frontal zone off of northern Honshu, Virginia weakened to storm force and became extratropical the following day.

The strongest wind reported along the Japanese coast was 67 kt with gusts to 95 kt at the Chosi weather station. Virginia interacted with a weak frontal area along the southern coast of Honshu causing torrential rain (Up to 22 inches in a 24-hour period at Katsuma) to fall along the coast which triggered landslides and considerable flooding. Approximately 200 houses were totally or partially destroyed while over 13,800 dwellings were flooded. Hardest hit was the Chiba prefecture where 56 persons were reported killed by the landslides which buried numerous homes (Figures 39 and 40).

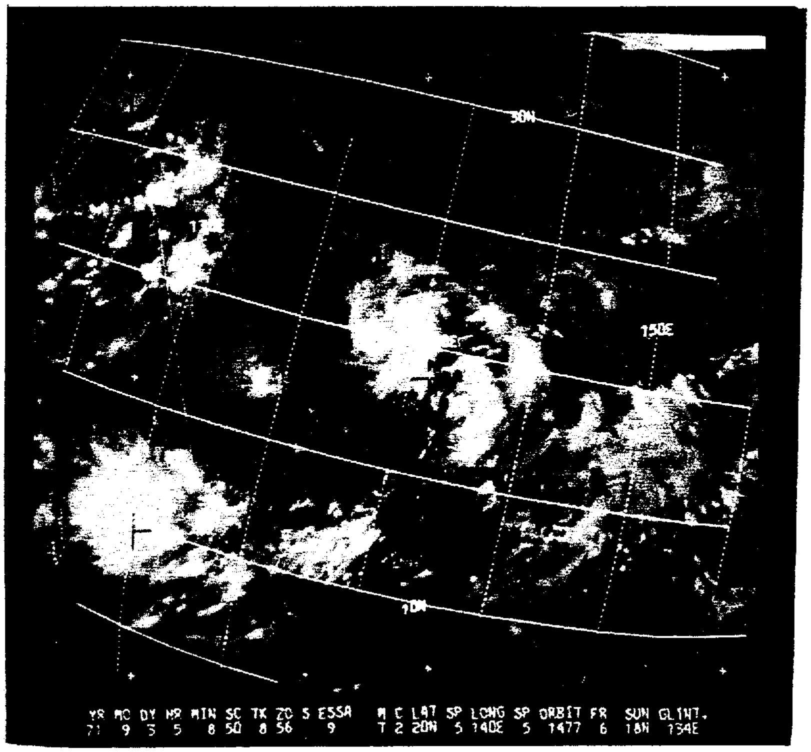


FIGURE 5-37. TROPICAL STORM VIRGINIA 300 N MI SOUTHWEST OF IWO JIMA ON 3 SEPTEMBER.

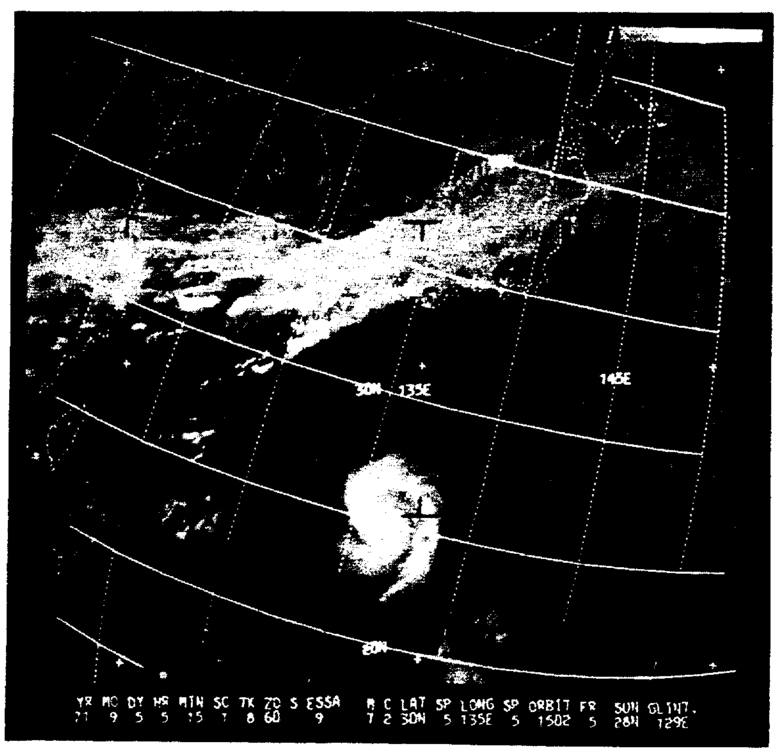


FIGURE 5-38. TYPHOON VIRGINIA AS VIEWED ON 5 SEPTEMBER BY ESSA-9.

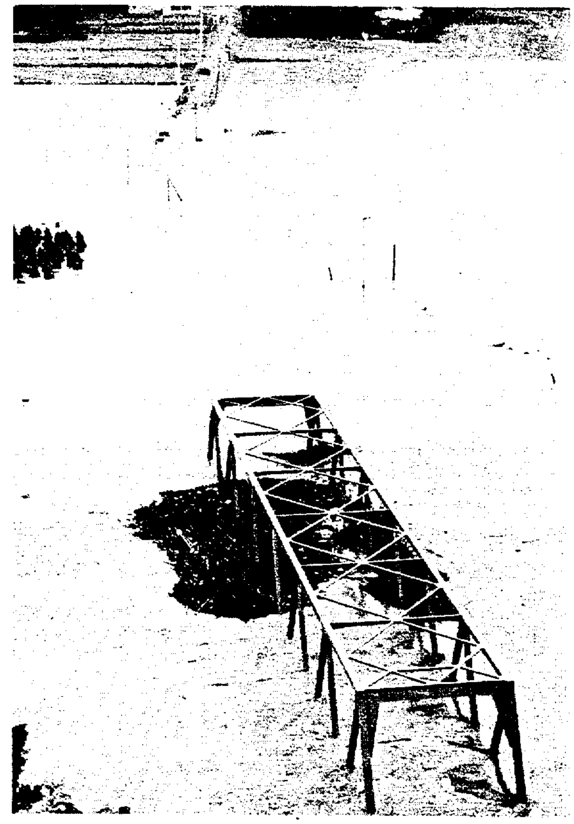


FIGURE 5-39. (LEFT) LANDSLIDES IN THE CHIBA PREFECTURE (BOSO PENINSULA, JAPAN) 8 SEPTEMBER RESULTING FROM TORRENTIAL RAINS OF TYPHOON VIRGINIA--COURTESY THE ASAHI SHIMBUN, TOKYO.
FIGURE 5-40. (RIGHT) FLOODS OVER THE BRIDGE 8 SEPTEMBER IN THE ISUMIGAWA IN THE CHIBA PREFECTURE (BOSO PENINSULA, JAPAN) RESULTING FROM TORRENTIAL RAINS OF TYPHOON VIRGINIA--COURTESY THE ASAHI SHIMBUN, TOKYO.

TYPHOON VIRGINIA
EYE FIXES FOR CYCLONE NO. 26
02 SEP - 07 SEP 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	300000Z	9.5N 135.5E	----------	-----	----	----	----	----	--/--	----	-----	--	--	SFC ANAL POSIT	
2	301200Z	13.0N 133.0E	----------	-----	----	----	----	----	--/--	----	-----	--	--	SFC ANAL POSIT	
3	010000Z	17.0N 135.0E	----------	-----	----	----	----	----	--/--	----	-----	--	--	SFC ANAL POSIT	
4	010018Z	18.4N 138.0E	54-P------	700MB	45	30	1001	3082	11/--	----	-----	--	--	FOR BNDS FRMG-700 CNTR 30NM E	
5	010930Z	18.4N 138.0E	----------	-----	----	----	----	----	--/--	----	-----	--	--	PIREP-APPNT CIRC	
6	012240Z	18.5N 138.6E	54-P- 5- 5	700MB	36	45	1004	3109	13/11	----	-----	--	--	MOT FB SE	
7	020305Z	18.7N 138.6E	54-P- 5- 5	700MB	40	50	1001	3091	12/11	----	-----	--	--	WC FRMG E QUAD	
8	020410Z	18.5N 139.0E	SATELIT---	STG C										FIRST BLTN	
9	021029Z	19.6N 138.5E	VQ-P-10---	-----	----	22	1008	----	26/24	CIRC		40	--	POORLY ORGANIZED	
10	021534Z	20.0N 138.3E	VQ-P- 8---	700MB	----	35	1009	----	27/24	CIRC		30	--	LRG CLD MASS TO E	
11	022200Z	18.8N 139.2E	54-P- 5- 5	700MB	50	50	1000	3051	13/08	CIRC		15	--	WC NE QUAD-700 CNTR 5NM NE	
12	030400Z	19.0N 138.2E	54-P- 5- 3	700MB	57	60	992	3033	02/02	CIRC		25	--	CLSD WC	
13	030508Z	19.5N 139.0E	SATELIT---	STG C										BETTER ORGANIZED	
14	031131Z	20.8N 138.1E	VQ-P- 5---	-----	----	55	994	----	27/24	ELIP	E-W	21X16	5	CLSD WC	
15	031554Z	21.2N 137.6E	VQ-P- 5---	700MB	----	----	993	3072	16/09	ELIP	E-W	15X12	7	CLSD WC	
16	032140Z	21.4N 137.5E	54-P- 3- 3	700MB	58	50	993	3008	13/10	CIRC		20	--	WC OPEN E QUAD	
17	040305Z	22.1N 137.3E	54-P- 6- 4	700MB	60	50	990	3011	11/08	CIRC		16	3	WC OPEN NW-700 CNTR 4NM NNW	
18	040607Z	22.0N 137.0E	SATELIT---	STG X	DIA	2	CAT 2.0								
19	041000Z	22.2N 137.1E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		6	4	CLSD WC	21.2N 137.4E
20	041602Z	23.1N 136.9E	VQ-R- 5-10	-----	----	----	----	----	--/--	CIRC		6	7	CLSD WC	23.0N 136.2E
21	050210Z	24.5N 136.4E	54-P- 6- 2	700MB	93	100	----	2691	15/10	CIRC		12	3	CLSD WC-700 CNTR 8NM NE	
22	050408Z	24.8N 136.5E	54-P- 4- 4	700MB	91	----	955	2707	17/12	CIRC		8	--	CLSD WC	
23	050515Z	25.5N 136.0E	SATELIT---	STG X	DIA	3	CAT 3.0								
24	051625Z	26.7N 136.0E	54-P- 3- 3	700MB	70	72	977	2882	17/10	CIRC		8	--	WC OPEN W	
25	052101Z	27.3N 136.2E	54-P- 3- 3	700MB	70	55	964	2795	15/12	CIRC		10	--	POORLY DEFINED	
26	060310Z	28.1N 136.3E	VQ-R- 3- 5	-----	----	----	----	----	--/--	CIRC		10	--	WC OPEN E-SW EYE DIMLY VSBL	27.1N 135.9E
27	060610Z	28.0N 136.5E	SATELIT---	STG X	DIA	3	CAT 3.0								
28	060940Z	28.5N 136.8E	54-P- 5- 5	700MB	65	----	965	2795	15/--	CIRC		20	10	CLSD WC	
29	061500Z	29.4N 137.0E	54-P- 3- 5	700MB	80	----	969	2792	16/11	CIRC		20	--	CLSD WC	
30	061925Z	30.3N 137.3E	54-P- 3- 5	700MB	70	----	970	2893	17/12	CIRC		25	5	WC OPEN NW	
31	062155Z	30.7N 137.5E	54-P- 3- 3	700MB	50	65	970	2893	17/11	CIRC		25	--	WC OPEN NW	
32	062200Z	30.4N 137.7E	LND RDR---							----	-----	--	--	MT FUJI	35.3N 138.7E
33	062300Z	30.6N 138.0E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
34	070100Z	31.4N 138.1E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
35	070100Z	31.4N 137.6E	54-P- 3- 3	700MB	60	70	980	2932	20/11	CIRC		25	--	POORLY DEFINED	
36	070200Z	31.6N 138.3E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
37	070300Z	31.8N 138.2E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
38	070315Z	31.9N 138.2E	54-P- 3- 5	700MB	45	55	----	2954	16/11	CIRC		25	--	POORLY DEFINED	
39	070400Z	32.1N 139.2E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
40	070500Z	32.3N 138.7E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
41	070517Z	32.3N 138.5E	SATELIT---	STG C.											
42	070600Z	32.5N 138.5E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
43	070700Z	32.6N 138.6E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
44	070715Z	32.9N 138.6E	54-P- 2- 3	700MB	75	60	970	2896	16/13	----	-----	--	--	POORLY DEFINED	
45	070800Z	33.0N 139.0E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
46	070900Z	32.9N 139.9E	LND RDR---							----	-----	--	--	STN RJTT	35.5N 139.8E

TYPHOON VIRGINIA
EYE FIXES FOR CYCLONE NO. 26
02 SEP - 07 SEP 71

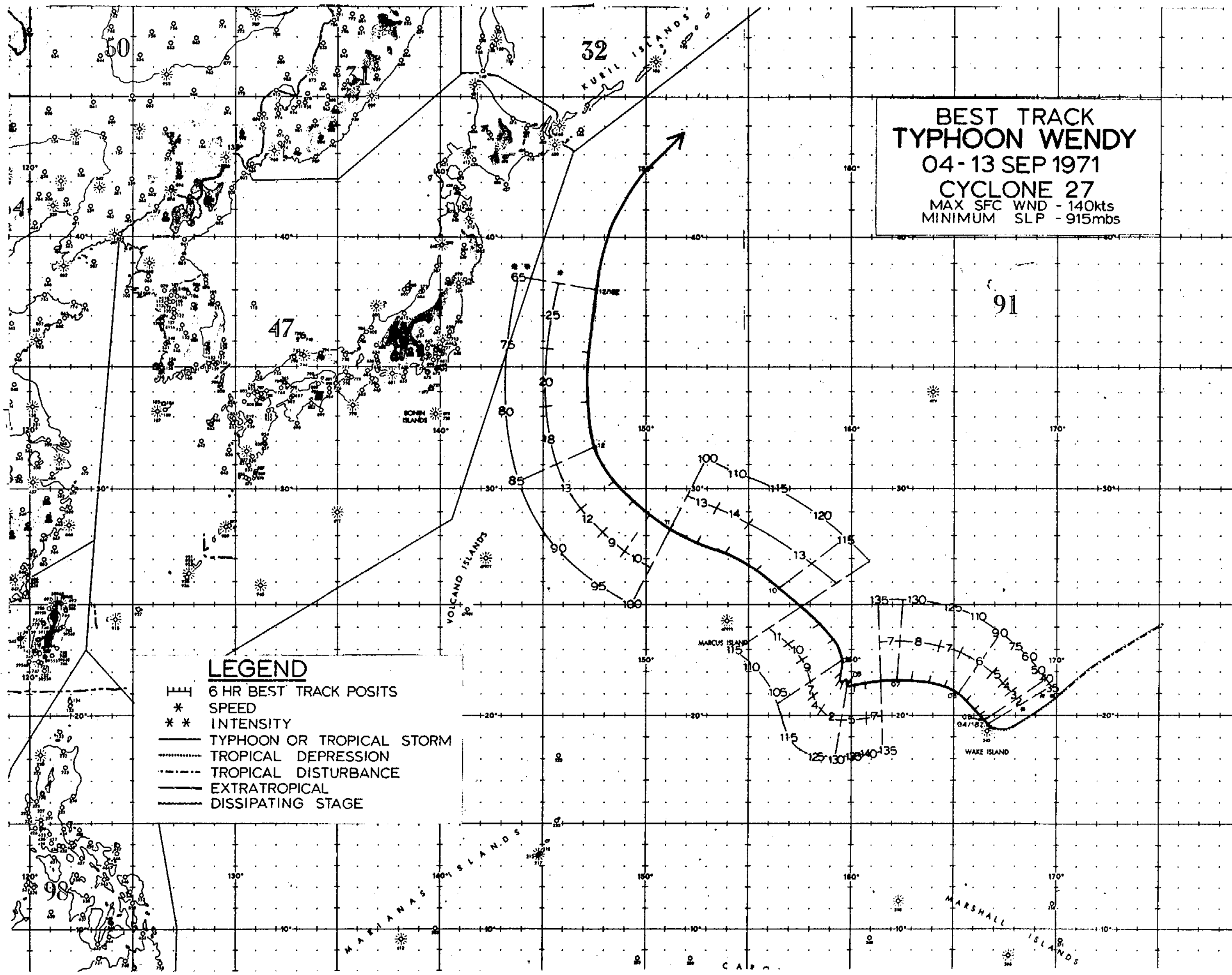
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
47	070915Z	33.2N 138.8E	54-P- 2- 3	700MB	50	45	980	2935	16/13	----	-----	--	--	POORLY DEFINED	
48	071000Z	33.4N 139.1E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
49	071100Z	33.5N 139.2E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
50	071300Z	34.0N 139.8E	LND RDR---							----	-----	--	--	STN 47639	35.3N 138.7E
51	071314Z	34.3N 139.8E	54-P- 1- 5	700MB	78	----	970	2871	15/11	CIRC		20	5	CLSD WC	
52	071536Z	35.0N 140.4E	54-P- 2- 5	700MB	80	----	976	2868	15/10	CIRC		20	5	CLSD WC	
53	080000Z	37.2N 143.3E	LND RDR---							----	-----	--	--	STN 47590	38.3N 140.9E

TYPHOON VIRGINIA

0000Z 2 SEP TO 1200Z 7 SEP

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
020000Z	18.6N 138.5E	45	18.5N 138.5E	45	6	0	18.6N 138.9E	55	115	5	20.0N 140.3E	55	199	-5	23.8N 141.6E	55	279	-45
020600Z	19.1N 138.5E	40	18.8N 138.7E	45	21	5	20.3N 139.3E	55	64	-5	22.7N 139.8E	55	151	-10	--.- ---.-	--	--	--
021200Z	19.7N 138.4E	35	19.4N 139.0E	30	38	-5	21.5N 139.7E	40	106	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
021800Z	20.2N 138.3E	40	20.1N 139.0E	30	40	-10	22.4N 139.2E	40	106	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
030000Z	20.4N 138.2E	50	19.7N 138.7E	50	50	0	21.8N 137.9E	55	33	-5	24.5N 136.9E	55	32	-45	27.2N 136.0E	55	34	-25
030600Z	20.6N 138.2E	60	19.0N 137.9E	60	97	0	18.9N 134.4E	80	253	15	19.7N 131.1E	90	427	-5	--.- ---.-	--	--	--
031200Z	20.9N 137.9E	60	20.9N 138.0E	60	6	0	22.0N 136.0E	70	69	-5	23.3N 133.3E	75	221	-15	25.0N 130.3E	75	421	-5
031800Z	21.3N 137.7E	60	21.2N 137.4E	60	18	0	22.4N 135.1E	75	106	-15	23.7N 132.5E	85	272	0	--.- ---.-	--	--	--
040000Z	21.8N 137.3E	60	21.5N 137.3E	60	18	0	22.5N 135.2E	65	119	-35	23.7N 132.6E	70	311	-10	25.7N 129.8E	75	525	5
040600Z	22.3N 137.1E	65	22.2N 136.9E	60	13	-5	23.3N 134.9E	65	126	-30	24.4N 132.8E	70	309	-10	--.- ---.-	--	--	--
041200Z	22.8N 136.9E	75	22.2N 136.9E	60	36	-15	23.2N 135.3E	65	165	-25	24.4N 133.2E	70	334	-10	26.0N 130.6E	75	651	5
041800Z	23.4N 136.7E	90	23.3N 136.7E	60	6	-30	24.8N 135.1E	65	133	-20	26.4N 132.5E	70	324	-5	--.- ---.-	--	--	--
050000Z	24.1N 136.5E	100	24.2N 136.3E	60	12	-40	27.2N 135.1E	60	70	-20	31.3N 138.8E	40	57	-30	--.- ---.-	--	--	--
050600Z	24.9N 136.4E	95	25.0N 136.3E	100	8	5	28.3N 135.9E	90	37	10	33.7N 139.5E	60	95	-10	--.- ---.-	--	--	--
051200Z	25.8N 136.3E	90	25.8N 136.1E	95	11	5	28.9N 136.1E	75	42	-5	34.7N 140.8E	50	88	-20	--.- ---.-	--	--	--
051800Z	26.8N 136.2E	85	26.9N 136.4E	85	12	0	31.0N 138.2E	60	83	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060000Z	27.7N 136.3E	80	27.8N 135.9E	80	22	0	32.4N 138.3E	60	83	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	28.3N 136.6E	80	28.7N 136.4E	75	26	-5	33.3N 139.0E	65	62	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	28.9N 136.9E	80	29.0N 136.7E	70	12	-10	33.6N 139.5E	50	13	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	29.9N 137.2E	75	29.9N 137.2E	70	0	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	31.1N 137.7E	70	31.1N 137.8E	60	5	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070600Z	32.4N 138.4E	70	32.7N 138.9E	55	31	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
071200Z	33.8N 139.4E	70	34.0N 139.7E	45	19	-25	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	22NM	94NM	217NM	382NM	22NM	94NM	217NM	382NM
AVERAGE RIGHT ANGLE ERROR	17NM	65NM	152NM	250NM	17NM	65NM	152NM	250NM
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	15KTS	13KTS	17KTS	8KTS	15KTS	13KTS	17KTS
AVERAGE BIAS OF WIND ERROR	-7KTS	-12KTS	-13KTS	-13KTS	-7KTS	-12KTS	-13KTS	-13KTS
NUMBER OF FORECASTS	23	19	13	5	23	19	13	5


BEST TRACK
TYPHOON WENDY
04-13 SEP 1971
CYCLONE 27
MAX SFC WND - 140kts
MINIMUM SLP - 915mbs
LEGEND
6 HR BEST TRACK POSITS
* SPEED
* * INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
KURIL ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
MARSHALL ISLANDS

WENDY

Destined to spend her entire life at sea, Wendy formed from a disturbance initiated by a circulation in the upper tropospheric mid-Pacific trough and was first noted by satellite on September 2nd east of Wake Island. This system drifted southwestward and became a tropical storm just north of Wake Island on the morning of the 4th (Figure 5-41). As the storm began a slow drift of 2-5 kt in a northwest direction during the next 24 hours, winds of typhoon force were acquired. The effects on Wake resulted in 6.24 inches of rainfall during Wendy's passage with a sustained wind of 42 kt measured on the 5th and a gust to 50 kt registered on the 6th.

Intensification of the typhoon proceeded at a rapid pace until late on the 7th when peak winds of 140 kt were reached. Reports from reconnaissance crews at this time described one of the largest and most panoramic eyes of the year--a circular, closed, wall cloud with colisium-like features encompassing an eye 40 n mi in diameter (Figure 5-42).

With Virginia skirting Japan, the subtropical ridge north of Marcus weakened considerably and began to rebuild east of Ocean Station Victor. As a reflection to this readjustment, Wendy began to stall for a 24-hour period on the 8th, then commenced a north and later northwest track. The area dominated by the storm's circulation began to spread at this time stretching over a vast region of some 900 n mi in diameter.

Wendy maintained her northwest track for two days before rounding the periphery of the ridge line. On the 11th she began a recurvature some 400 miles east of Japan (Figure 5-43). With a trough in the westerlies situated along the coast of Manchuria, the typhoon began to accelerate in forward speed from 16 kt on the 12th to 37 kt on the 13th. Dropping to storm strength and merging with a frontal system east of Hokkaido, Wendy ended her life as a tropical system on the 13th.

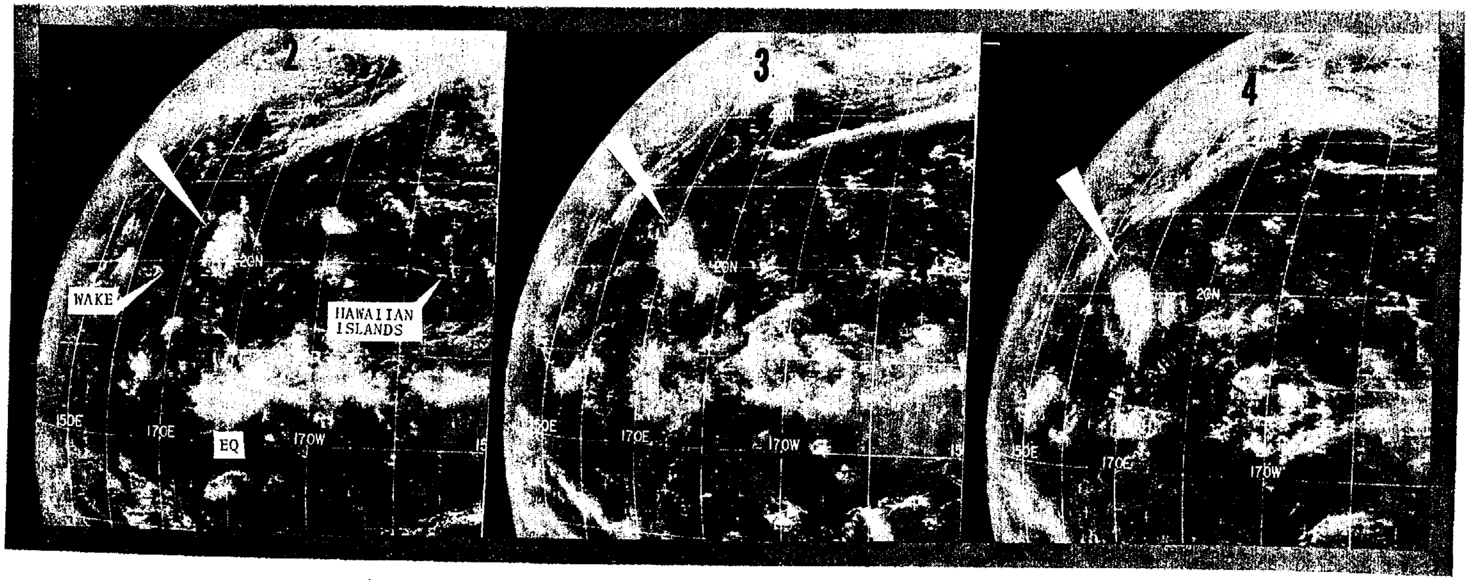
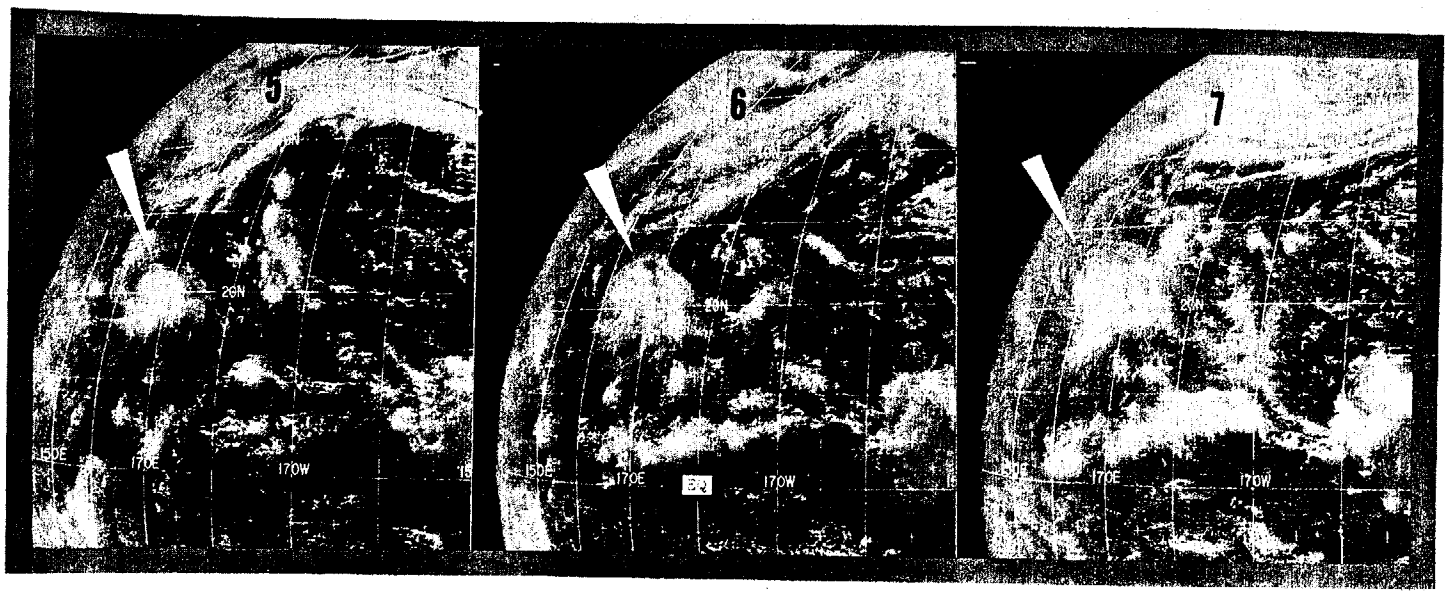


FIGURE 5-41. ATS-1 GEOSTATIONARY SATELLITE VIEW OF BIRTH AND DEVELOPMENT OF TYPHOON WENDY 2-7 SEPTEMBER.



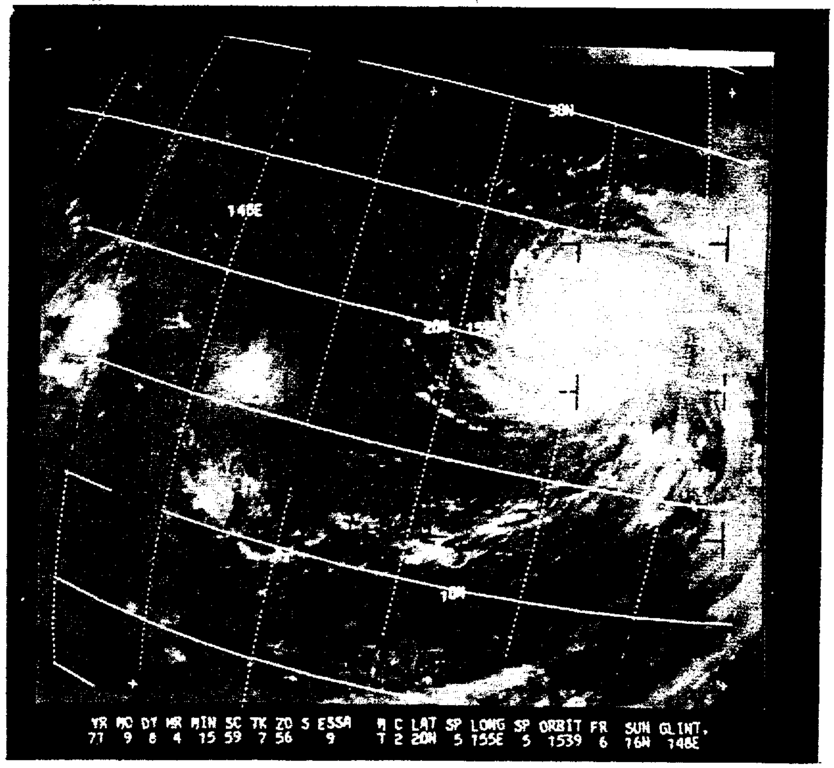


FIGURE 5-42. SUPER TYPHOON WENDY AT HER PEAK LOCATED BETWEEN MARCUS AND WAKE ISLAND AS VIEWED BY ESSA-9 ON 8 SEPTEMBER.

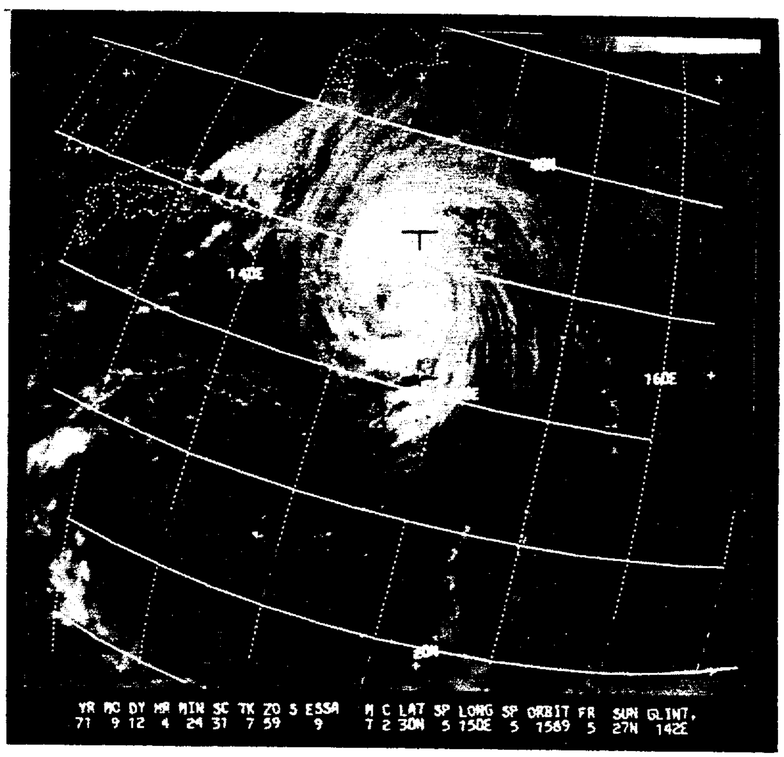


FIGURE 5-43. ESSA-9 SIGHTS TYPHOON WENDY WELL EAST OF JAPAN ON 12 SEPTEMBER.

TYPHOON WENDY
EYE FIXES FOR CYCLONE NO. 27
04 SEP - 13 SEP 71

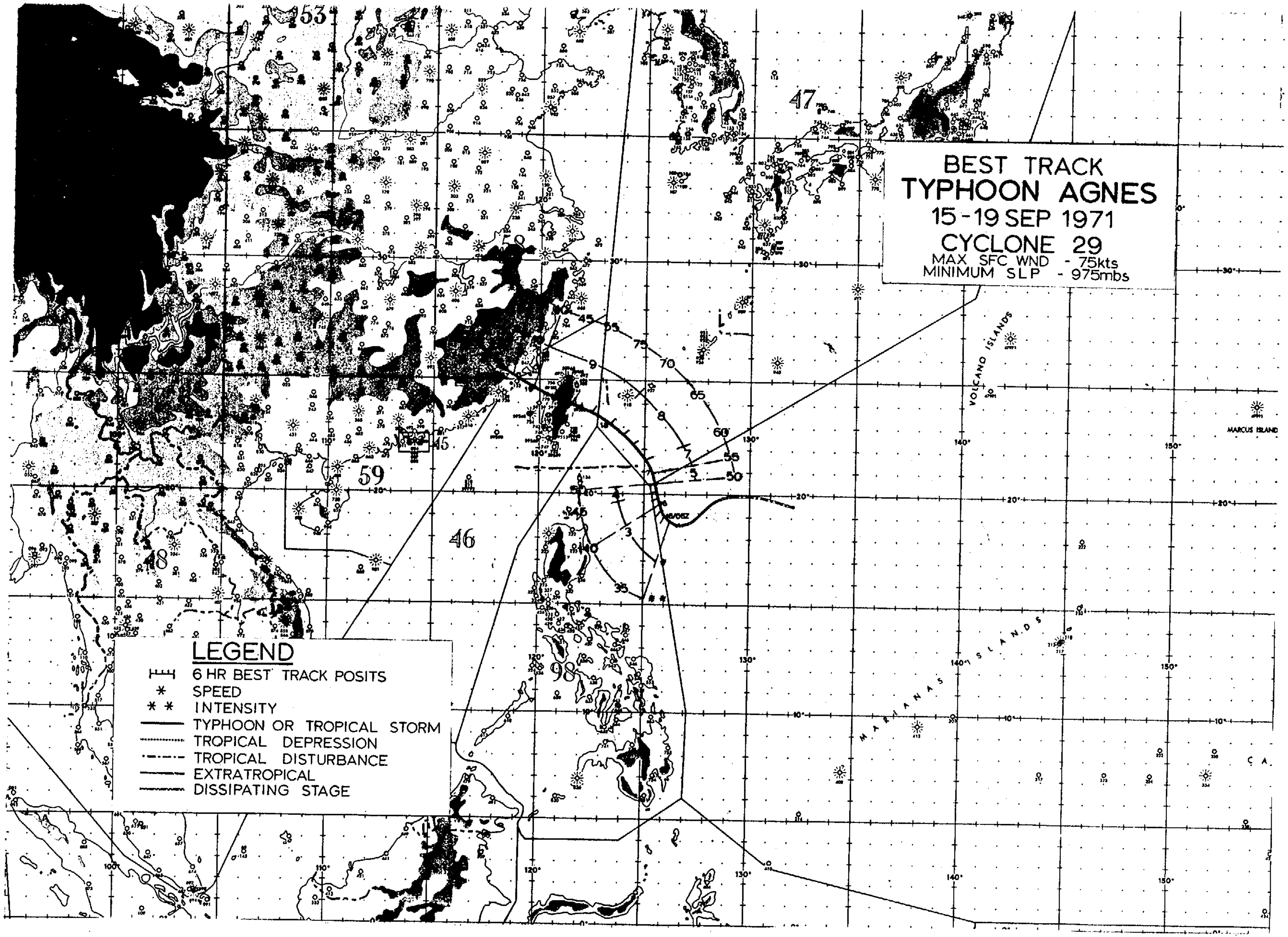
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TAITION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	030313Z	22.0N 170.0E	SATELIT---	STG B										FIRST BLTN	
2	040404Z	19.0N 167.0E	SATELIT---	STG B											
3	042130Z	19.7N 166.5E	54-P- 2---	700MB	40	40	992	3012	14/14	----	-----	--	--	LGT FB ACTIVITY	
4	050315Z	19.8N 166.0E	SATELIT---	STG C+										MORE INTFNSE	
5	050510Z	19.9N 166.4E	54-P- 1- 1	700MB	42	45	984	2954	12/09	CIRC		20	--	STG FB E SEMIC	
6	050810Z	20.2N 166.3E	54-P- 1- 3	700MB	50	50	982	2944	13/07	CIRC		25	--	WC FRMG E - 700 CNTR 3NM NW	
7	051630Z	20.6N 165.9E	54-P- 3-12	700MB	70	----	974	2816	20/17	CIRC		20	5	WC OPEN NW	
8	052120Z	20.7N 165.5E	54-P- 2- 8	700MB	70	75	974	2804	17/15	CIRC		30	3	WC OPEN NW-700 CNTR 8NM ESE	
9	060352Z	21.2N 164.9E	54-P- 4- 1	700MB	90	120	951	2682	16/07	CIRC		30	5	CLSD WC-700 CNTR	
10	060414Z	21.0N 165.0E	SATELIT---	STG X	DIA	2 CAT	3.5							MORE INTENSE	
11	060910Z	21.4N 164.1E	54-P- 2- 2	700MB	110	----	938	2566	17/08	CIRC		10	7	CLSD WC-FL FIX 2NM NW	
12	061615Z	21.4N 163.1E	54-P- 4- 6	700MB	75	----	926	2441	20/15	CIRC		10	5	CLSD WC	
13	062130Z	21.6N 162.7E	54-P- 5- 5	700MB	100	55	923	2408	19/14	CONC	-	20X 7	10	BOTH WC CLSD	
14	070320Z	21.5N 161.8E	54-P- 6- 6	700MB	110	135	928	2413	16/10	CONC	-	30X10	10	BOTH WC CLSD	
15	070322Z	21.2N 161.8E	SATELIT---	STG X	DIA	3 CAT	4.0							MORE INTENSE	
16	071028Z	21.6N 160.7E	54-P- 2- 3	700MB	95	----	915	2338	23/11	CONC	-	35X25	7	BOTH WC CLSD	
17	071630Z	21.4N 160.5E	54-P- 5- 5	700MB	70	----	917	2362	21/--	CIRC		35	3	CLSD WC	
18	072130Z	21.3N 159.8E	54-P- 5-10	700MB	100	----	----	----	20/16	CIRC		35	--	CLSD WC-SFC CNTR 17NM SW	
19	080355Z	21.5N 159.8E	54-P-10- 3	700MB	105	----	930	2463	17/13	CIRC		35	--	CLSD WC-FL FIX	
20	080416Z	21.5N 159.8E	SATELIT---	STG X	DIA	3 CAT	4.0							LITTLE CHANGE	
21	081117Z	21.4N 159.6E	54-P- 3---	700MB	90	----	941	2530	14/10	CIRC		40	8	CLSD WC	
22	081540Z	21.7N 159.0E	54-P- 3- 5	700MB	85	----	940	2533	16/12	CIRC		40	3	WC OPEN NW-FL FIX	
23	090002Z	22.5N 159.6E	VQ-P- 8- 7	-----	----	65	953	----	26/25	CIRC		40	10	WC OPEN NW	
24	090323Z	23.0N 159.0E	SATELIT---	STG X	DIA	3 CAT	3.0							LRG RAGGED EYE	
25	090347Z	23.1N 159.3E	VQ-P- 8- 7	-----	----	80	951	----	27/25	ELIP	NE-SW	40X25	8	WC OPEN W	
26	091020Z	24.0N 158.5E	54-P- 2- 3	700MB	76	----	948	2643	14/11	CIRC		33	--	CLSD WC	
27	091315Z	24.5N 157.9E	54-P------	700MB	----	----	940	2573	16/--	----	-----	--	--		
28	091600Z	24.5N 158.0E	54-P- 2- 3	700MB	80	----	936	2530	15/11	ELIP	E-W	45X30	--	CLSD WC-SML BKS	
29	092155Z	25.3N 156.7E	54-P-10- 5	700MB	100	65	916	2518	18/12	ELIP	SE-NW	35X30	--	CLSD WC	
30	100300Z	26.1N 156.1E	54--------	-----	----	----	----	----	--/--	----	-----	--	--		
31	100300Z	26.1N 156.1E	54-P-17- 3	700MB	105	60	928	2490	17/13	ELIP	SE-NW	35X25	12	CLSD WC	
32	100422Z	26.5N 155.5E	SATELIT---	STG X	DIA	3 CAT	3.5							LITTLE CHANGE	
33	101050Z	27.0N 154.1E	VQ-P- 2- 2	700MB	----	----	922	2481	21/17	CIRC		30	6	CLSD WC	
34	101540Z	27.5N 153.2E	VQ-R- 8---	-----	----	----	----	----	--/--	CIRC		25	12	CLSD WC	26.3N 153.2E
35	102200Z	27.9N 151.5E	54-P- 6- 2	700MB	75	80	933	2496	15/13	CIRC		9	--	WC OPEN N	
36	110325Z	28.0N 150.5E	SATELIT---	STG X	DIA	4 CAT	3.5								
37	111015Z	29.3N 149.8E	54-P- 2- 3	700MB	70	----	948	2646	16/13	CIRC		25	--	WC OPEN NE-SW	
38	111559Z	30.0N 149.0E	54-P-10- 3	700MB	55	----	945	2609	17/14	CIRC		30	--	WC OPEN S SEMIC	
39	111805Z	30.3N 148.4E	54-P-15-10	700MB	52	----	944	2618	18/16	CIRC		30	--	WC OPEN S QUAD	
40	120330Z	32.9N 147.3E	VQ-R-30---	-----	----	----	----	----	--/--	----	-----	--	--		
41	120425Z	33.0N 147.0E	SATELIT---	STG X	DIA	4 CAT	3.0								
42	120430Z	33.3N 147.3E	VQ-P- 3- 7	-----	----	85	952	----	26/24	CIRC		27	5	WC OPEN SW	
43	121020Z	34.8N 147.1E	VQ-P- 4---	-----	----	55	951	----	26/26	CIRC		25	8	WC OPEN S	
44	121501Z	36.5N 147.6E	VQ-P- 8---	700MB	----	----	956	2749	18/16	CIRC		25	--	WC OPEN S	
45	122200Z	40.3N 148.3E	54-P- 5- 5	700MB	50	50	963	2762	15/12	CIRC		25	--	NO WC	

TYPHOON WENDY

1800Z 4 SEP TO 0000Z 13 SEP

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
041800Z	19.6N	166.7E	35	20.0N	166.0E	30	46	-5	20.0N	163.8E	45	109	-30	--.-	---.-	--	--	--	--.-	---.-	--	--	--
050000Z	19.8N	166.5E	40	19.7N	166.2E	45	18	5	20.1N	163.3E	70	119	-20	20.8N	160.0E	75	126	-55	21.9N	157.3E	80	143	-50
050600Z	20.0N	166.3E	50	19.9N	166.4E	50	8	0	20.0N	165.8E	65	106	-45	20.8N	163.8E	75	142	-60	--.-	---.-	--	--	--
051200Z	20.3N	166.0E	60	20.3N	166.1E	55	6	-5	21.1N	164.7E	70	55	-55	21.5N	161.7E	80	61	-60	21.5N	158.3E	30	67	-85
051800Z	20.7N	165.6E	75	20.7N	165.8E	65	11	-10	21.3N	163.8E	80	53	-50	21.5N	160.4E	90	21	-45	--.-	---.-	--	--	--
060000Z	21.0N	165.2E	90	20.7N	165.3E	75	19	-15	20.9N	162.7E	100	54	-30	20.9N	158.9E	110	56	-20	20.5N	154.2E	120	313	15
060600Z	21.3N	164.5E	110	21.2N	164.6E	110	8	0	21.8N	161.7E	120	20	-15	21.7N	157.4E	130	128	5	--.-	---.-	--	--	--
061200Z	21.5N	163.8E	125	21.5N	163.8E	115	0	-10	21.8N	160.0E	135	38	-5	21.5N	155.3E	140	234	25	21.4N	150.1E	140	485	30
061800Z	21.6N	162.9E	130	21.5N	162.8E	120	8	-10	21.4N	158.3E	140	100	5	21.3N	153.1E	140	357	25	--.-	---.-	--	--	--
070000Z	21.6N	162.1E	130	21.5N	162.3E	125	13	-5	21.4N	158.2E	140	89	10	21.3N	153.6E	140	329	35	21.4N	149.0E	140	484	25
070600Z	21.6N	161.4E	135	21.5N	161.4E	130	6	-5	21.5N	157.3E	150	133	25	21.4N	152.7E	145	371	40	--.-	---.-	--	--	--
071200Z	21.5N	160.6E	140	21.5N	160.4E	135	11	-5	21.4N	156.2E	150	184	35	21.6N	151.5E	145	408	35	22.7N	146.9E	140	465	25
071800Z	21.3N	160.1E	135	21.5N	159.8E	140	21	5	21.4N	155.8E	145	207	30	21.7N	151.2E	145	395	30	--.-	---.-	--	--	--
080000Z	21.3N	159.8E	130	21.2N	159.1E	140	39	10	20.9N	155.3E	145	247	40	21.5N	151.1E	140	388	25	22.5N	147.4E	135	400	35
080600Z	21.5N	159.7E	125	21.4N	159.6E	135	8	10	21.2N	156.3E	130	199	25	21.3N	152.9E	130	337	10	--.-	---.-	--	--	--
081200Z	21.4N	159.5E	115	21.4N	159.5E	120	0	5	21.2N	157.6E	120	179	10	21.1N	155.1E	120	370	5	21.4N	151.7E	120	499	30
081800Z	21.8N	159.5E	115	21.7N	159.4E	120	8	5	21.7N	158.1E	120	194	5	21.7N	155.6E	120	396	10	--.-	---.-	--	--	--
090000Z	22.5N	159.4E	105	22.3N	159.6E	110	16	5	24.2N	158.6E	105	145	-10	25.9N	156.8E	100	335	0	27.6N	154.3E	100	429	15
090600Z	23.3N	159.1E	105	23.4N	159.2E	105	8	0	25.5N	157.4E	100	128	-20	27.2N	154.9E	100	268	5	--.-	---.-	--	--	--
091200Z	24.1N	158.4E	110	24.1N	158.3E	105	5	-5	26.3N	154.8E	115	72	0	28.1N	152.5E	115	183	25	30.3N	150.5E	105	352	30
091800Z	24.9N	157.5E	115	24.8N	157.8E	115	17	0	27.3N	155.0E	115	135	5	29.4N	152.3E	110	206	20	--.-	---.-	--	--	--
100000Z	25.7N	156.5E	115	25.5N	156.4E	115	13	0	27.7N	152.4E	120	77	20	30.5N	149.2E	115	113	30	--.-	---.-	--	--	--
100600Z	26.5N	155.3E	120	26.5N	155.7E	110	21	-10	29.3N	152.3E	100	112	5	32.4N	150.6E	80	187	0	--.-	---.-	--	--	--
101200Z	27.2N	153.9E	115	27.2N	153.9E	110	0	-5	30.3N	150.0E	100	57	10	33.6N	149.0E	80	144	5	--.-	---.-	--	--	--
101800Z	27.7N	152.5E	110	27.8N	152.8E	110	17	0	31.1N	149.6E	100	70	10	34.3N	149.1E	80	233	15	--.-	---.-	--	--	--
110000Z	28.3N	151.1E	100	28.0N	151.0E	100	19	0	30.0N	146.0E	95	135	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--
110600Z	28.9N	150.2E	95	28.5N	149.6E	100	39	5	30.8N	145.2E	85	188	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--
111200Z	29.5N	149.4E	90	29.3N	149.2E	95	16	5	32.0N	146.9E	80	210	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--
111800Z	30.4N	148.5E	90	30.2N	148.8E	95	20	5	33.8N	147.2E	80	252	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
120000Z	31.8N	147.6E	85	31.3N	147.6E	85	30	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
120600Z	33.5N	147.1E	80	33.7N	147.4E	80	19	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
121200Z	35.5N	147.2E	75	35.3N	147.1E	75	13	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
121800Z	38.0N	147.6E	65	37.5N	147.9E	65	33	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	16NM	126NM	241NM	364NM	16NM	126NM	241NM	364NM
AVERAGE RIGHT ANGLE ERROR	9NM	74NM	160NM	258NM	9NM	74NM	160NM	258NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	19KTS	24KTS	34KTS	5KTS	19KTS	24KTS	34KTS
AVERAGE BIAS OF WIND ERROR	-1KTS	-0KTS	4KTS	7KTS	-1KTS	-0KTS	4KTS	7KTS
NUMBER OF FORECASTS	33	29	24	10	33	29	24	10


BEST TRACK
TYPHOON AGNES
15-19 SEP 1971
CYCLONE 29
MAX SFC WND - 75kts
MINIMUM SLP - 975mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARIANAS ISLANDS
MARCUS ISLAND

AGNES

The weak circulation which was to become Agnes had been followed on synoptic charts for close to a week in the west central Philippine Sea. On September 14th, satellite data and aircraft reconnaissance indicated signs of development, and by the following afternoon, September's third tropical storm had formed.

Guided by an extension of the subtropical ridge to the Ryukyus, Agnes slowly edged northward (Figure 5-44) and then shifted to a westerly course while she intensified to a typhoon on the 17th. Possible recurvature existed with a trough in the westerlies approaching the northern Yellow Sea at this time; however, its influence was not felt and Agnes followed the weak ridge making landfall on Taiwan between Hualein and Ilan early on the evening of the 18th (Figure 5-45). After crossing the Taiwan straits, Agnes arrived on the China mainland near Nanchang and dissipated as she moved inland.

Winds of 58 kt gusting to 78 kt were felt on the islands offshore of northeastern Taiwan while heavy rainfall produced by typhoon Agnes amounted up to 17.4 inches in 48 hours at Anpu in the mountainous terrain of the island. Flooding in Taipei was reported extremely serious as much of the lower areas of the city were badly flooded. Over 100 dwellings were partially or totally destroyed by the flooding; one person was reported killed and five others missing due to the typhoon.

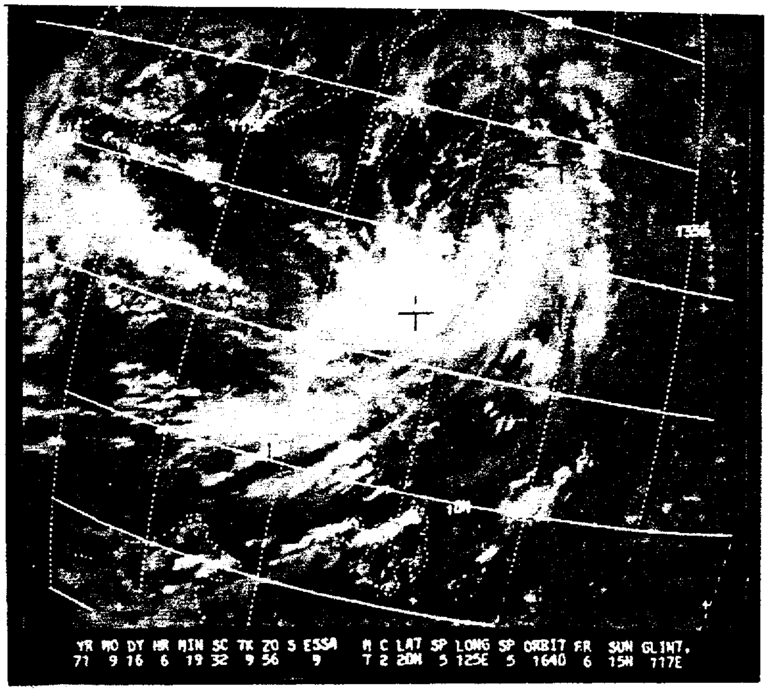


FIGURE 5-44. TROPICAL STORM AGNES NORTHEAST OF LUZON ON 16 SEPTEMBER.

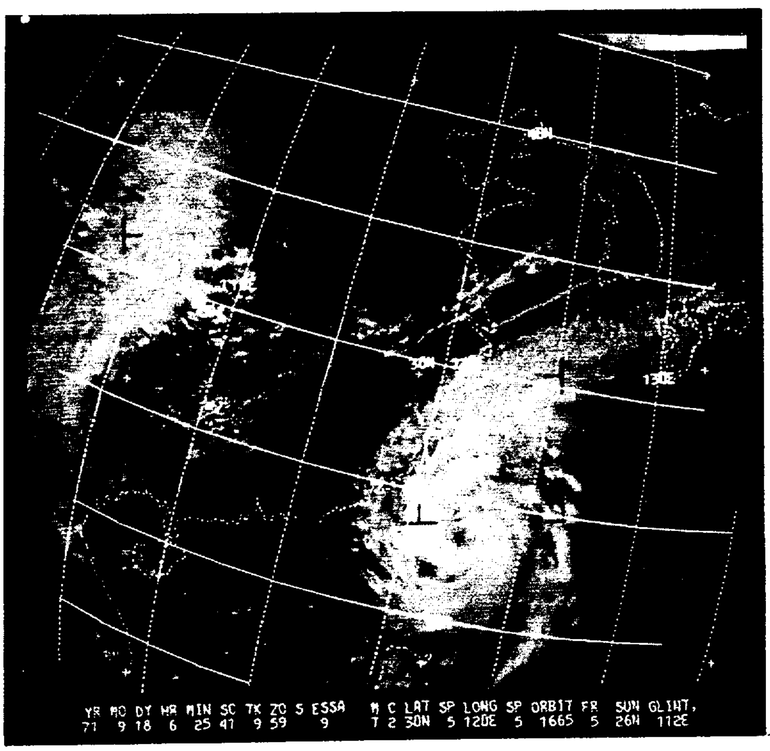


FIGURE 5-45. TYPHOON AGNES IS SIGHTED BY ESSA-9 ON 18 SEPTEMBER PRIOR TO LANDFALL ON TAIWAN.

TYPHOON AGNES

EYE FIXES FOR CYCLONE NO. 29

15 SEP - 19 SEP 71

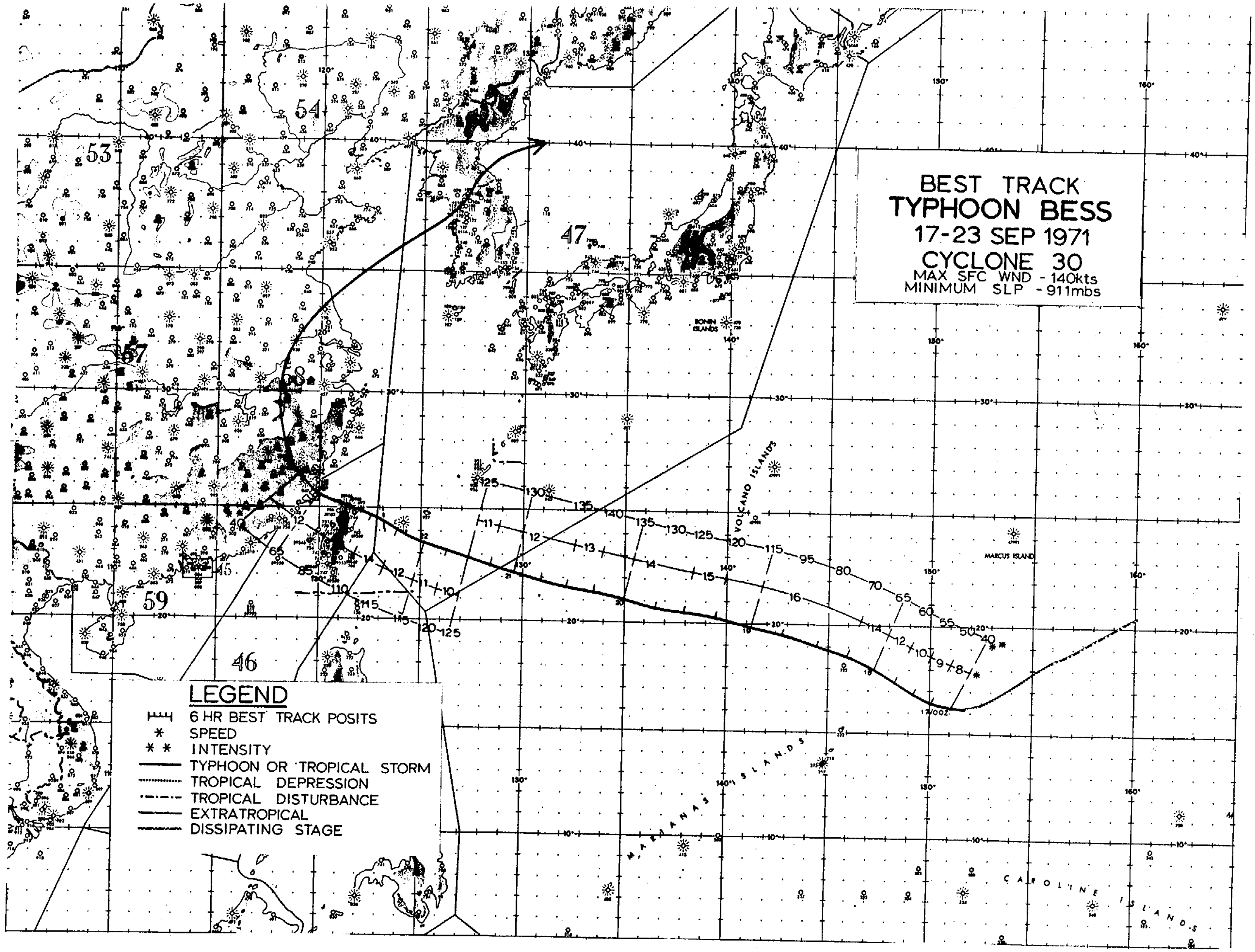
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	130519Z	16.0N 127.5E	SATELLITE---	STG B										FIRST BLTN	
2	140018Z	16.0N 126.0E	SATELLITE---	STG B										LESS ORGANIZED	
3	140553Z	19.5N 124.1E	VQ-P- 5-20	-----	----	25	1000	----	25/25	CIRC		35	--	NO ORGANIZ ON RDR	
4	150000Z	18.3N 127.0E	54-P------	700MB	35	----	----	----	--/--	----	-----	--	--	700MB WIND CNTR	
5	150521Z	19.0N 126.5E	SATELLITE---	STG C										BETTER ORGANIZED	
6	151030Z	19.1N 125.8E	54-P- 5-15	700MB	40	----	997	3027	08/08	----	-----	--	--	700MB WIND CNTR	
7	152120Z	19.4N 125.8E	54-P- 5- 5	700MB	40	35	992	3005	08/08	----	-----	--	--	NO RDR PRES	
8	160020Z	21.5N 125.5E	SATELLITE---	STG C										LITTLE CHANGE	
9	161008Z	19.4N 125.3E	54-P- 2-28	700MB	50	30	994	2987	09/08	----	-----	--	--	NO RDR PRES	
10	161200Z	20.3N 125.8E	VQ-P-10- 5	-----	----	55	991	----	26/22	CIRC		30	--	POORLY ORGANIZED	
11	162101Z	21.1N 125.0E	VQ-P-15- 5	-----	----	40	987	----	26/25	CIRC		45	--	BCMG MORE ORGANIZ	
12	170415Z	21.3N 125.2E	54-P- 5-15	700MB	40	35	984	2967	12/11	----	-----	--	--	NO WC-700MB CNTR 5NM W	
13	170522Z	21.5N 125.0E	SATELLITE---	STG C+										STRONGER	
14	170700Z	21.7N 125.1E	54-P- 5- 5	700MB	45	40	980	2917	11/11	----	-----	--	--	SAME AS 04157 RMK	
15	171000Z	22.3N 124.7E	54-P- 5- 5	700MB	50	45	976	2905	12/09	----	-----	--	--	NO WC	
16	171045Z	22.5N 124.3E	LND RDR---							----	-----	--	--	TAIWAN RDR	
17	171955Z	22.8N 124.2E	LND RDR---							----	-----	--	--	STN 46699	24.0N 121.6E
18	172100Z	23.2N 124.2E	LND RDR---							----	-----	--	--	STN 46699	24.0N 121.6E
19	172215Z	23.0N 123.8E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
20	172120Z	23.3N 123.8E	LND RDR---							----	-----	--	--	TAIWAN RDR	
21	172300Z	23.3N 123.0E	LND RDR---							----	-----	--	--	TAIWAN RDR	
22	172325Z	23.0N 123.1E	LND RDR---							----	-----	--	--	GOOD FIX-47927	24.8N 125.3E
23	180100Z	23.3N 123.0E	LND RDR---							----	-----	--	--	POOR FIX-47918	24.3N 124.2E
24	180105Z	23.1N 123.2E	VQ-P-15-10	-----	----	70	961	----	27/23	CIRC		40	--	NO WC-SST 85 DEG	
25	180300Z	23.8N 122.8E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
26	180355Z	23.6N 123.1E	VQ-P- 5- 5	-----	----	80	974	----	27/22	CIRC		40	--	NO WC	
27	180558Z	23.5N 122.6E	LND RDR---							----	-----	--	--	STN 47761	34.0N 131.5E
28	180430Z	23.3N 122.6E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
29	180540Z	23.0N 122.3E	LND RDR---							----	-----	--	--	STN 47761	34.0N 131.5E
30	180625Z	23.5N 122.5E	SATELLITE---	STG X DIA 3 CAT 4.0										STRONGER	
31	180634Z	23.7N 122.0E	VQ-P-10- 5	700MB	----	----	970	2880	16/13	CIRC		35	--	NO WC-SST 85 DEG	
32	180740Z	23.9N 122.7E	LND RDR---							----	-----	--	--	FUCHU RDR	
33	180820Z	24.0N 122.5E	LND RDR---							----	-----	--	--		
34	181030Z	23.8N 122.3E	54-P- 5-15	400MB	60	----	----	----	-7/-9	----	-----	--	--	NO RDR PRES	
35	182200Z	24.0N 120.1E	LND RDR---							----	-----	--	--	TAIWAN RDR	

TYPHOON AGNES

0600Z 15 SEP TO 0600Z 19 SEP

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS	
	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
150600Z	18.8N	126.3E	35	18.2N	126.4E	30	36	-5	18.2N	124.2E	40	128	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--
151200Z	19.0N	126.0E	35	18.2N	125.9E	30	48	-5	18.2N	123.4E	45	172	0	--.-	---.-	--	--	--	--.-	---.-	--	--	--
151800Z	19.2N	125.8E	40	18.8N	125.7E	30	25	-10	18.7N	123.3E	45	165	-5	--.-	---.-	--	--	--	--.-	---.-	--	--	--
160000Z	19.5N	125.7E	40	19.4N	125.6E	30	8	-10	20.3N	124.0E	45	86	-10	--.-	---.-	--	--	--	--.-	---.-	--	--	--
160600Z	19.8N	125.7E	40	19.8N	125.2E	30	28	-10	21.2N	123.3E	45	103	-15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
161200Z	20.1N	125.7E	45	19.5N	125.3E	30	42	-15	20.2N	124.0E	50	124	-15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
161800Z	20.4N	125.6E	50	20.4N	125.8E	45	11	-5	21.4N	125.1E	55	99	-10	22.8N	124.3E	60	217	15	--.-	---.-	--	--	--
170000Z	20.9N	125.4E	55	21.3N	124.7E	45	46	-10	23.9N	122.7E	55	58	-15	27.0N	122.5E	60	200	20	--.-	---.-	--	--	--
170600Z	21.6N	125.1E	60	21.4N	125.0E	45	13	-15	23.5N	123.4E	55	50	-20	25.9N	122.2E	60	188	25	--.-	---.-	--	--	--
171200Z	22.2N	124.6E	65	22.5N	124.5E	45	19	-20	24.9N	123.7E	60	124	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--
171800Z	22.7N	124.0E	65	23.2N	124.3E	50	34	-15	25.9N	123.8E	60	193	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
180000Z	23.1N	123.3E	70	23.2N	123.4E	65	8	-5	25.6N	122.0E	75	131	35	--.-	---.-	--	--	--	--.-	---.-	--	--	--
180600Z	23.6N	122.5E	75	23.7N	122.7E	70	12	-5	26.8N	122.4E	65	216	30	--.-	---.-	--	--	--	--.-	---.-	--	--	--
181200Z	24.1N	121.6E	55	24.3N	121.9E	70	20	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
181800Z	24.3N	120.7E	45	24.3N	121.3E	65	33	20	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
190000Z	24.7N	119.8E	40	24.3N	119.9E	50	25	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
190600Z	25.2N	118.8E	35	25.1N	118.8E	40	6	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	24NM	127NM	201NM	0NM	24NM	127NM	201NM	0NM
AVERAGE RIGHT ANGLE ERROR	19NM	94NM	102NM	0NM	19NM	94NM	102NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR	11KTS	13KTS	20KTS	0KTS	11KTS	13KTS	20KTS	0KTS
AVERAGE BIAS OF WIND ERROR	-5KTS	-0KTS	20KTS	0KTS	-5KTS	-0KTS	20KTS	0KTS
NUMBER OF FORECASTS	17	13	3	0	17	13	3	0


BEST TRACK
TYPHOON BESS
17-23 SEP 1971
CYCLONE 30
MAX SFC WND - 140kts
MINIMUM SLP - 911mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
VOLCANO ISLANDS
MARIANAS ISLANDS
CAROLINE ISLANDS
MARCUS ISLAND
BONIN ISLANDS

September's fourth typhoon developed from a disturbance associated with an upper tropospheric low that was first noted between Wake and Marcus Island by satellite on September 14th. The low aloft drifted southwestward and induced a circulation at the surface. (See Figure 5-46 for satellite view sequence of Bess.)

By the 17th, aircraft reconnaissance located Bess about 300 n mi east of the Marianas with associated maximum winds of 40 kt. Bess developed into a typhoon on September 18th passing near Agrihan Island that afternoon. On the morning of the 20th, Bess had intensified further to be the season's fifth super typhoon with maximum winds of 140 kt generated under her wall cloud encircling a 30 n mi eye (Figure 2-5). In the meantime, the typhoon's central pressure dipped to 906 mb* within a few hours.

With the subtropical ridge extending to the Ryukyu chain, Bess proceeded on a steady west-northwesterly track with forward speed gradually decreasing from 16 to 12 kt as she approached the southern Ryukyus. On the afternoon of the 22nd, the typhoon passed a few miles south of Ishigaki Jima and crossed directly over Younaguni Jima. Bess was measured at 91 kt gusting to 124 kt at the Japanese weather station on Younaguni Jima while Ishigaki Jima received 9.3 inches of rainfall during the typhoon's passage. The southern Ryukyu Islands reported two persons killed and more than 2,000 people made homeless. The islands were declared a major disaster area.

On the evening of September 22nd, Bess--the second typhoon to strike Taiwan during September--moved inland near Ilan which recorded a minimum sea level pressure of 955.5 mb. The eye of the storm, estimated at 40 n mi in diameter, passed over Taipei between 1420 and 1505 GMT. Highest sustained winds recorded were 108 kt at Pengchiayu and the maximum gust observed was 130 kt at Keelung. A storm surge of 9.9 ft was experienced at Tanshui on the island's northern coast during passage of the eye.

Bess emerged into the Taiwan Straits as a minimal typhoon in the early morning of the 23rd near Taoyuan and struck mainland China near Fuichow that afternoon.

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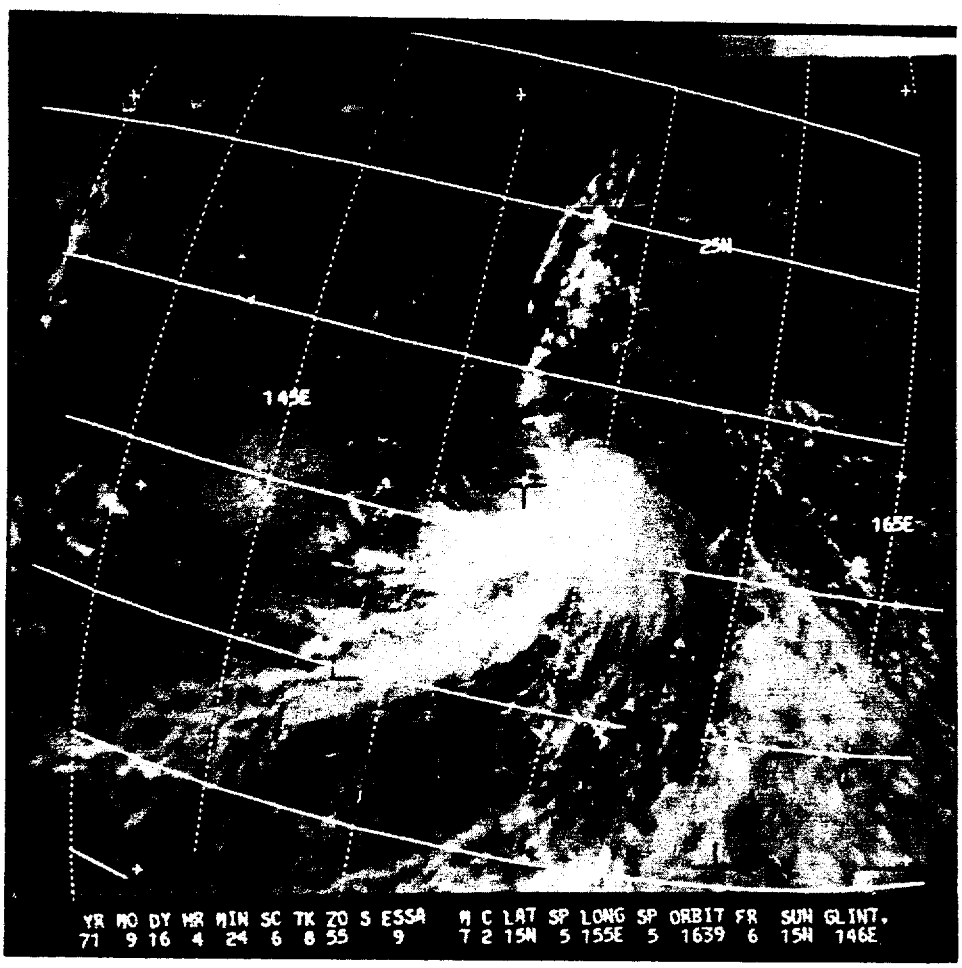
*Reduced from a minimum 700 mb height of 2268 m.

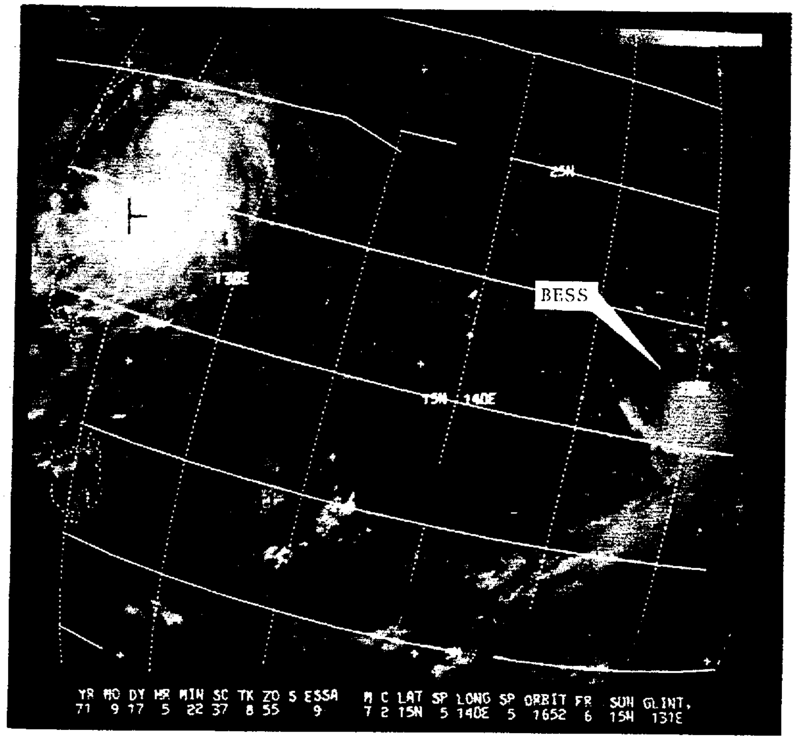
The storm weakened to depression status over land then, drifting northward, she recurved and crossed the Yellow Sea as an extratropical system.

Flooding in Taipei was extreme in places and all main roads branching out of Taipei were made temporarily impassable by the storm. The torrential rainfall in the mountainous terrain amounted to 18.7 inches at Alishan. The typhoon was also responsible for serious damage to rice, sugar cane and banana crops. In total, Bess accounted for 30 deaths with 6 reported missing and over 2,200 dwellings destroyed.

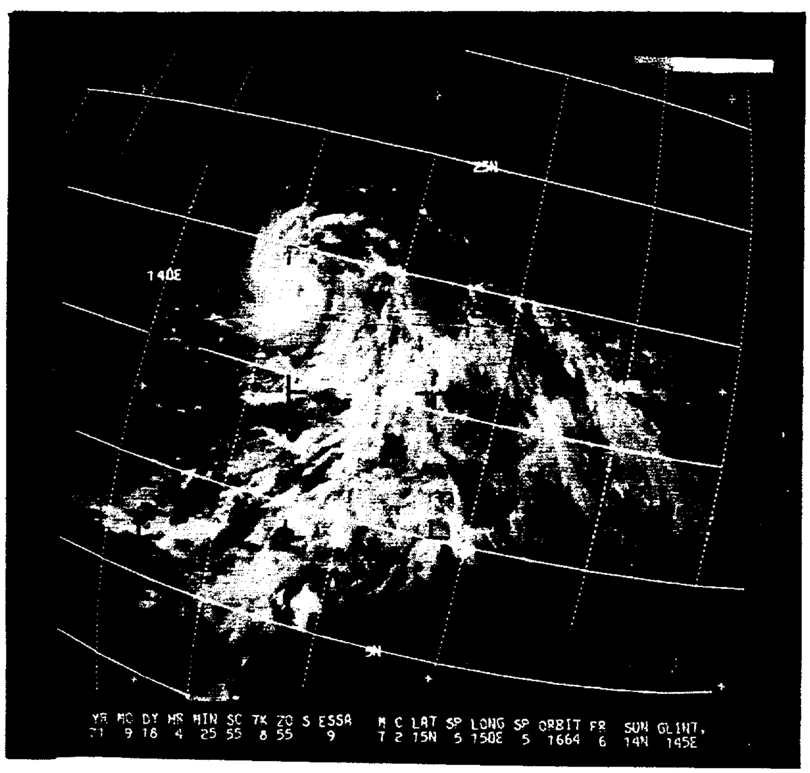
FIGURE 5-46. ESSA-9 VIEW SEQUENCE OF TYPHOON BESS.



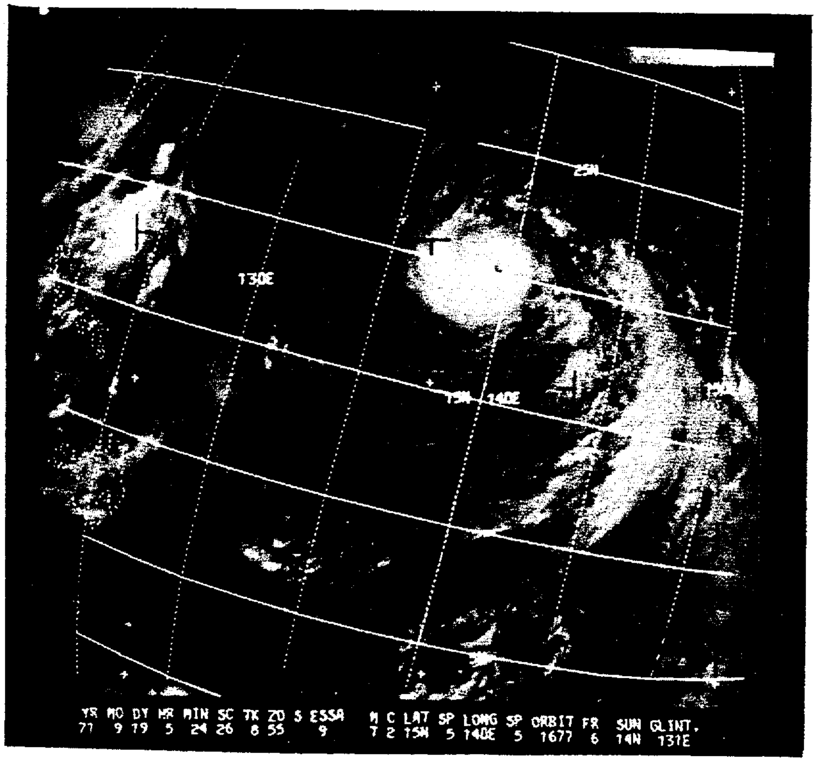
16 SEPTEMBER - TROPICAL DEPRESSION



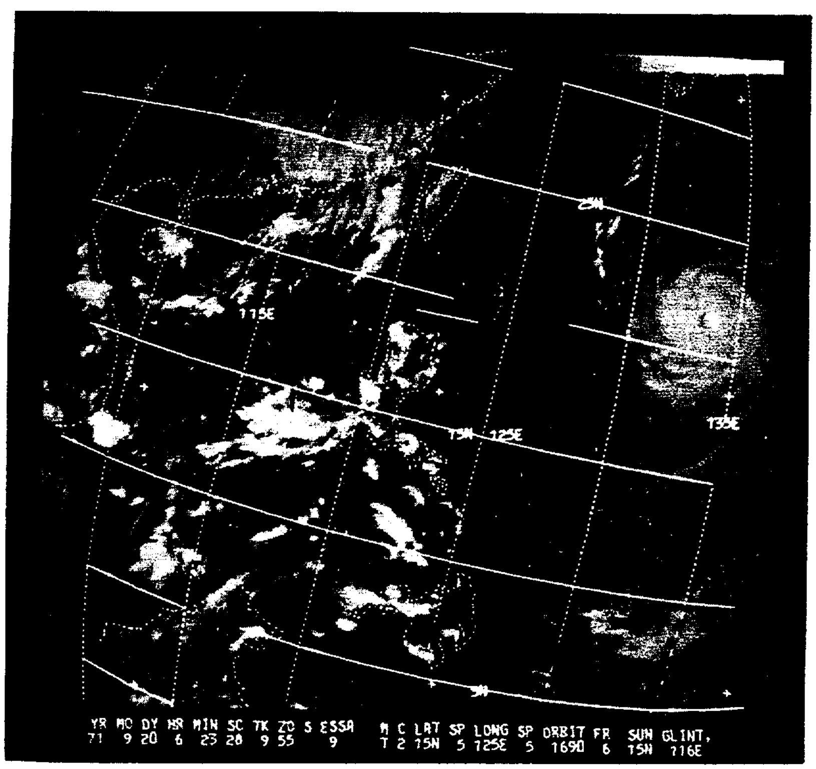
17 SEPTEMBER - TROPICAL STORM STAGE (AGNES IS SEEN ON WESTERN EDGE OF PHOTO.)



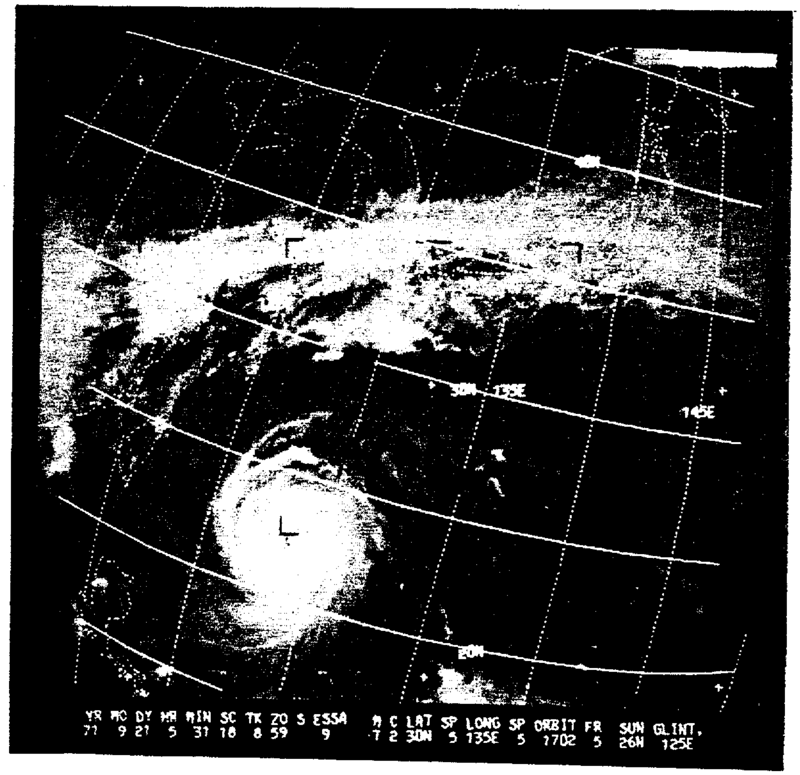
18 SEPTEMBER - TYPHOON STRENGTH 70 KT.



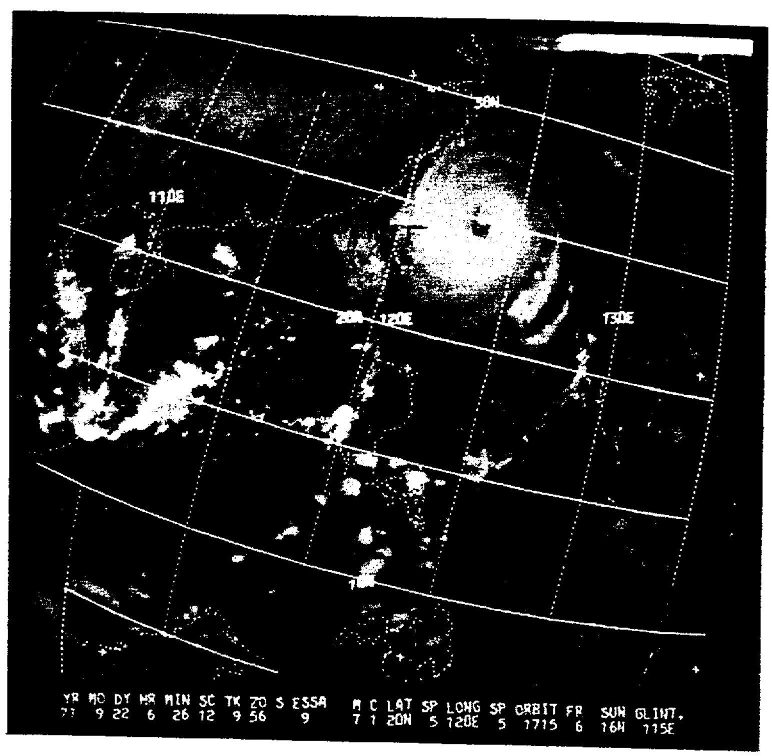
19 SEPTEMBER - TYPHOON STRENGTH 120 KT.



20 SEPTEMBER - SUPER TYPHOON STRENGTH (140 KT)



21 SEPTEMBER - TYPHOON STRENGTH (125 KT)



22 SEPTEMBER - TYPHOON STAGE (115 KT)

TYPHOON BESS
EYE FIXES FOR CYCLONE NO. 30
17 SEP - 23 SEP 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	160424Z	18.0N 154.5E	SATELIT---	STG B											
2	162305Z	16.3N 151.0E	54-P-10---	700MB	25	30	995	3033	12/12	CIRC		15	--	POORLY DEFINED	
3	170405Z	17.1N 149.6E	54-P- 5---	700MB	43	50	987	2987	14/09	CIRC		25	--	WC FRMG S SEMIC 700 CNTR 5NM NW	
4	170522Z	16.5N 150.0E	SATELIT---	STG X	DIA	3	CAT 2.0								
5	170955Z	16.9N 149.2E	VQ-R- 3- 9	-----	----	----	----	----	--/--	CIRC		12	5	WC FRMG E QUAD	16.7N 148.8E
6	171640Z	17.2N 148.6E	VQ-P- 8---	700MB	----	----	976	2941	16/12	CIRC		12	--	ILL-DEFINED WC	
7	172200Z	17.8N 147.5E	54-P-15---	700MB	50	60	980	2899	14/12	----	-----	--	--	POORLY DEFINED	
8	180345Z	18.3N 146.8E	54-P-15---	700MB	55	65	974	2871	14/11	----	-----	--	--	POORLY DEFINED	
9	180425Z	18.2N 146.0E	SATELIT---	STG X	DIA	2	CAT 3.0							IREG SHAPED EYE	
10	180954Z	18.8N 144.9E	VQ-P- 2- 2	-----	----	90	970	----	26/23	CIRC		28	--	POORLY DEFINED	
11	181550Z	19.1N 143.3E	VQ-P- 1- 2	700MB	----	100	954	2758	26/23	CIRC		24	3	CLSD WC	
12	182230Z	19.8N 141.5E	54-P- 2- 3	700MB	100	110	927	2499	21/11	CIRC		22	7	CLSD WC	
13	190320Z	20.0N 140.3E	54-P- 4- 3	700MB	105	120	916	2402	26/14	CIRC		18	6	CLSD WC-700 CNTR 7NM NNW	
14	190524Z	20.1N 139.6E	SATELIT---	STG X	DIA	3	CAT 4.0							EYE VISIBLE	
15	190952Z	19.1N 139.1E	VQ-R- 3- 8	-----	----	----	----	----	--/--	CIRC		19	6	CLSD WC	19.6N 140.6E
16	191620Z	20.6N 136.9E	VQ-P- 3- 2	700MB	----	----	914	2346	21/11	CIRC		18	7	CLSD WC	
17	192230Z	21.0N 135.4E	54-P- 5- 5	700MB	110	120	924	2429	19/09	CIRC		30	7	CLSD WC	
18	200623Z	21.5N 133.5E	SATELIT---	STG X	DIA	4	CAT 4.0							FYE VISIBLE	
19	201720Z	21.7N 131.1E	VQ-R-15---	-----	----	----	----	----	--/--	----	-----	--	--	EST POSIT	21.0N 132.9E
20	201844Z	21.9N 130.7E	VQ-P- 3---	700MB	----	----	911	2369	19/14	CIRC		30	6	CLSD WC	
21	202144Z	22.1N 130.3E	VQ-P- 3---	700MB	----	----	926	2384	19/11	CIRC		30	--	CLSD WC	
22	210110Z	22.2N 129.6E	54-P- 5- 5	700MB	110	----	----	----	18/14	CIRC		30	7	CLSD WC	
23	210349Z	22.4N 129.0E	54-P- 3- 5	700MB	100	100	----	----	18/13	CIRC		30	7	CLSD WC	
24	210531Z	22.2N 128.8E	SATELIT---	STG X	DIA	4	CAT 4.0							EYE VISIBLE	
25	210600Z	22.6N 128.6E	54-P- 3- 3	700MB	100	----	----	----	18/12	CIRC		30	7	CLSD WC	
26	210800Z	22.5N 128.3E	LND RDR---							----	-----	--	--		
27	210900Z	22.8N 127.5E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
28	211000Z	22.8N 127.5E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
29	210955Z	22.8N 127.0E	54-P- 5- 3	700MB	100	80	921	2385	17/13	ELIP	NE-SW	24X20	12	CLSD WC	
30	211100Z	22.7N 127.4E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
31	211240Z	23.0N 127.0E	54-P- 5- 4	700MB	100	----	----	----	18/14	CONC	-	60X25	10	CLSD WC-INNER EYE	
32	211300Z	22.7N 127.1E	LND RDR---							----	-----	--	--	STN 47927 ELLIPTICAL 20X30	24.8N 125.3E
33	211400Z	22.7N 126.9E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
34	211500Z	22.7N 126.8E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
35	211530Z	22.9N 126.7E	54-P- 5- 3	700MB	100	----	926	----	17/11	CIRC		80	6	CLSD WC-INNER EYE DISSIPATING	
36	211600Z	22.8N 126.7E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
37	211800Z	23.1N 126.2E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
38	211900Z	23.2N 126.1E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
39	211949Z	23.3N 126.0E	VQ-R-15---	-----	----	----	----	----	--/--	CIRC		18	6	WC OPEN SE QUAD	22.2N 126.2E
40	212000Z	23.3N 126.0E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
41	212000Z	23.1N 125.8E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
42	212200Z	23.4N 125.5E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
43	212210Z	23.4N 125.6E	VQ-P- 5- 3	700MB	----	----	944	2621	17/10	ELIP	N-S	25X15	--	CLSD WC	
44	212300Z	23.4N 125.2E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
45	212300Z	23.4N 125.3E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
46	220000Z	23.4N 125.0E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E

TYPHOON BESS
EYE FIXES FOR CYCLONE NO. 30
17 SEP - 23 SEP 71

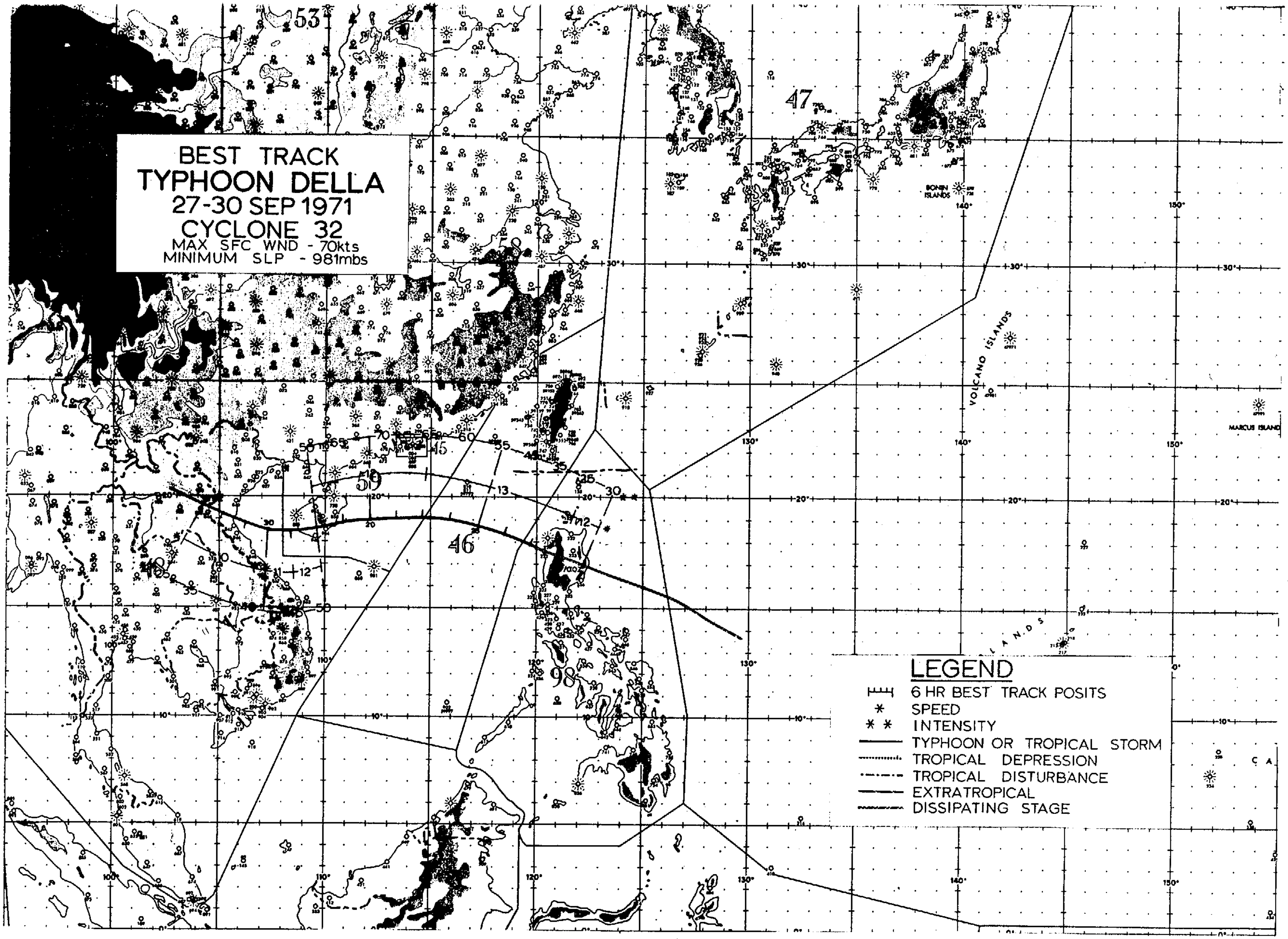
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
47	220000Z	23.4N 125.0E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
48	220014Z	23.5N 125.2E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		20	9		22.5N 124.6E
49	220130Z	23.3N 124.8E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
50	220200Z	23.6N 124.6E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
51	220200Z	23.5N 124.7E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
52	220230Z	23.5N 124.5E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
53	220300Z	23.6N 124.6E	LND RDR---							----	-----	--	--	STN 46763	34.0N 131.5E
54	220300Z	23.6N 124.4E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
55	220300Z	23.7N 124.4E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
56	220400Z	23.7N 124.3E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
57	220400Z	23.7N 124.3E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
58	220419Z	23.8N 124.2E	54-P- 3- 5	700MB	110	----	943	2576	17/10	CIRC		40	--	CLSD WC	
59	220515Z	23.7N 124.0E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
60	220600Z	23.8N 123.9E	LND RDR---							----	-----	--	--	TAIPEI RDR	25.0N 121.5E
61	220600Z	23.9N 124.0E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
62	220626Z	24.8N 123.6E	SATELIT---	STG X	DIA	4	CAT 4.0							EYE VISIBLE	
63	220700Z	24.1N 123.8E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
64	220700Z	24.0N 123.6E	54-P- 3- 2	700MB	120	----	940	2570	17/11	CIRC		40	--	CLSD WC	
65	220700Z	23.9N 123.8E	LND RDR---							----	-----	--	--	SUNGSHAN RDR	
66	220800Z	24.2N 123.7E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
67	220900Z	24.3N 123.4E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
68	220900Z	24.3N 123.2E	54-P- 5- 5	700MB	100	----	940	2585	17/10	CIRC		40	--	CLSD WC-TOPS 35K	
69	220900Z	24.3N 123.4E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
70	221000Z	24.5N 123.2E	LND RDR---							----	-----	--	--	STN 47927	24.8N 125.3E
71	221000Z	24.5N 123.2E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
72	221200Z	24.3N 122.6E	LND RDR---							----	-----	--	--	STN 47918	24.3N 124.2E
73	221236Z	25.0N 122.6E	VQ-R- 3-15	-----	----	----	----	----	--/--	----	-----	--	--	POOR RDR PRES	24.9N 123.7E
74	221240Z	24.7N 122.3E	LND RDR---							----	-----	--	--	TAIPEI RDR	25.0N 121.5E
75	221300Z	24.7N 122.2E	LND RDR---							----	-----	--	--		
76	221300Z	24.8N 122.3E	LND RDR---							----	-----	--	--	TAIWAN RDR	
77	221500Z	25.0N 121.5E	----------	-----	----	----	----	----	--/--	----	-----	--	--	EYE POSIT TAIPEI	
78	221627Z	25.2N 121.3E	VQ-R- 3-20	-----	----	----	----	----	--/--	----	-----	--	--	V POOR RDR PRES	25.8N 121.6E

TYPHOON BESS

0000Z 17 SEP TO 0600Z 23 SEP

	BEST TRACK			WARNING				24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS
	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
170000Z	16.3N	150.9E	40	16.4N	150.9E	30	6	-10	17.1N	147.7E	50	58	-15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
170600Z	16.5N	150.0E	50	16.7N	149.2E	50	47	0	18.1N	144.6E	75	85	5	19.6N	140.7E	95	79	-25	--.-	---.-	--	--	--
171200Z	16.9N	149.2E	55	17.0N	148.8E	60	24	5	18.0N	144.8E	85	64	5	19.4N	141.0E	100	186	-25	21.0N	137.6E	110	308	-20
171800Z	17.3N	148.3E	60	17.2N	148.3E	60	6	0	18.1N	145.0E	85	150	-10	19.3N	141.4E	100	287	-30	--.-	---.-	--	--	--
180000Z	18.0N	147.3E	65	17.9N	147.1E	65	13	0	19.9N	143.4E	80	124	-35	22.1N	140.4E	100	306	-35	24.4N	138.1E	110	484	-20
180600Z	18.6N	146.0E	70	18.4N	146.5E	70	31	0	20.4N	143.4E	85	218	-35	22.4N	140.7E	100	404	-40	--.-	---.-	--	--	--
181200Z	19.0N	144.4E	80	19.0N	144.3E	90	6	10	21.4N	139.2E	110	90	-15	24.2N	135.6E	120	247	-15	27.4N	133.6E	125	434	0
181800Z	19.5N	142.8E	95	19.2N	142.9E	95	19	0	21.4N	137.7E	115	79	-15	24.1N	134.0E	125	215	-5	--.-	---.-	--	--	--
190000Z	19.9N	141.2E	115	19.9N	141.2E	110	0	-5	21.8N	135.0E	125	42	-10	24.4N	130.6E	125	142	-5	27.5N	127.9E	125	283	10
190600Z	20.3N	139.5E	120	20.2N	139.7E	120	13	0	22.1N	134.1E	135	58	-5	24.9N	129.9E	130	160	0	--.-	---.-	--	--	--
191200Z	20.5N	137.9E	125	20.4N	138.2E	125	18	0	22.7N	133.0E	130	82	-5	25.5N	129.3E	120	190	-5	28.5N	126.6E	110	312	0
191800Z	20.7N	136.5E	130	20.8N	136.4E	130	8	0	22.8N	131.1E	130	55	0	25.3N	127.3E	120	137	0	--.-	---.-	--	--	--
200000Z	21.1N	135.0E	135	21.1N	135.0E	125	0	-10	22.8N	129.3E	110	39	-20	25.0N	124.6E	100	94	-15	27.6N	120.7E	85	125	20
200600Z	21.3N	133.5E	140	21.4N	133.5E	130	6	-10	22.7N	127.7E	120	39	-10	24.4N	122.9E	105	59	-10	--.-	---.-	--	--	--
201200Z	21.6N	132.1E	135	21.8N	131.8E	130	20	-5	23.1N	126.0E	115	72	-10	24.8N	121.1E	90	82	-20	--.-	---.-	--	--	--
201800Z	21.9N	130.9E	130	22.1N	130.4E	130	30	0	23.5N	124.5E	110	100	-10	25.3N	119.7E	65	82	-20	--.-	---.-	--	--	--
210000Z	22.2N	129.6E	130	22.3N	129.8E	125	13	-5	24.3N	126.2E	110	77	-5	26.3N	123.0E	95	166	30	--.-	---.-	--	--	--
210600Z	22.6N	128.4E	130	22.5N	128.6E	120	13	-10	24.7N	124.3E	105	47	-10	27.0N	121.3E	90	128	50	--.-	---.-	--	--	--
211200Z	22.9N	127.3E	125	23.0N	127.2E	115	8	-10	25.4N	122.7E	100	42	-10	--.-	---.-	--	--	--	--.-	---.-	--	--	--
211800Z	23.2N	126.3E	120	23.2N	126.3E	115	0	-5	25.5N	121.9E	100	45	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
220000Z	23.5N	125.1E	115	23.6N	125.3E	110	12	-5	25.8N	121.4E	90	76	25	--.-	---.-	--	--	--	--.-	---.-	--	--	--
220600Z	24.0N	123.9E	115	24.0N	123.9E	105	0	-10	25.8N	119.4E	75	42	35	--.-	---.-	--	--	--	--.-	---.-	--	--	--
221200Z	24.7N	122.6E	110	24.6N	122.6E	100	6	-10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
221800Z	25.1N	121.2E	85	25.1N	120.7E	80	27	-5	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
230000Z	25.6N	120.0E	65	25.7N	120.2E	75	12	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
230600Z	26.4N	119.0E	40	26.2N	119.1E	60	13	20	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	13NM	77NM	174NM	324NM	13NM	77NM	174NM	324NM
AVERAGE RIGHT ANGLE ERROR	7NM	41NM	96NM	218NM	7NM	41NM	96NM	218NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	14KTS	19KTS	13KTS	6KTS	14KTS	19KTS	13KTS
AVERAGE BIAS OF WIND ERROR	-2KTS	-6KTS	-10KTS	-3KTS	-2KTS	-6KTS	-10KTS	-3KTS
NUMBER OF FORECASTS	26	22	17	6	26	22	17	6


BEST TRACK
TYPHOON DELLA
27-30 SEP 1971
CYCLONE 32
MAX SFC WND - 70kts
MINIMUM SLP - 981mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND

DELLA

Della cut across northern Luzon on the 27th as an intensifying tropical depression. Early signs of her existence can be traced to the central Philippine Sea near 14N 130E on the 25th as evidenced by satellite and ship data (Figure 5-47). Emerging into the South China Sea, Della was steered on a westerly track by an extension of the subtropical ridge into South China. Della developed to minimal typhoon force late on the 28th bringing the month's total to five. After her transit of Hainan Island on the 29th (Figure 5-48), Della crossed the Gulf of Tonkin on the following day arriving ashore on the Vietnamese coast late in the day near Vinh. The remains of the storm dissipated shortly thereafter over northern Laos.

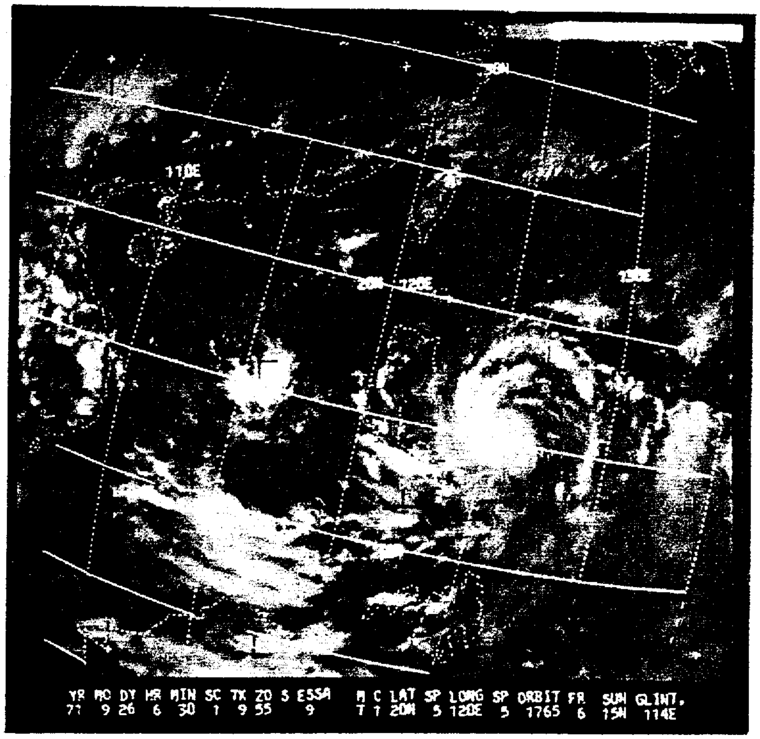


FIGURE 5-47. DELLA AS A DEVELOPING TROPICAL DEPRESSION EAST OF LUZON ON 26 SEPTEMBER.

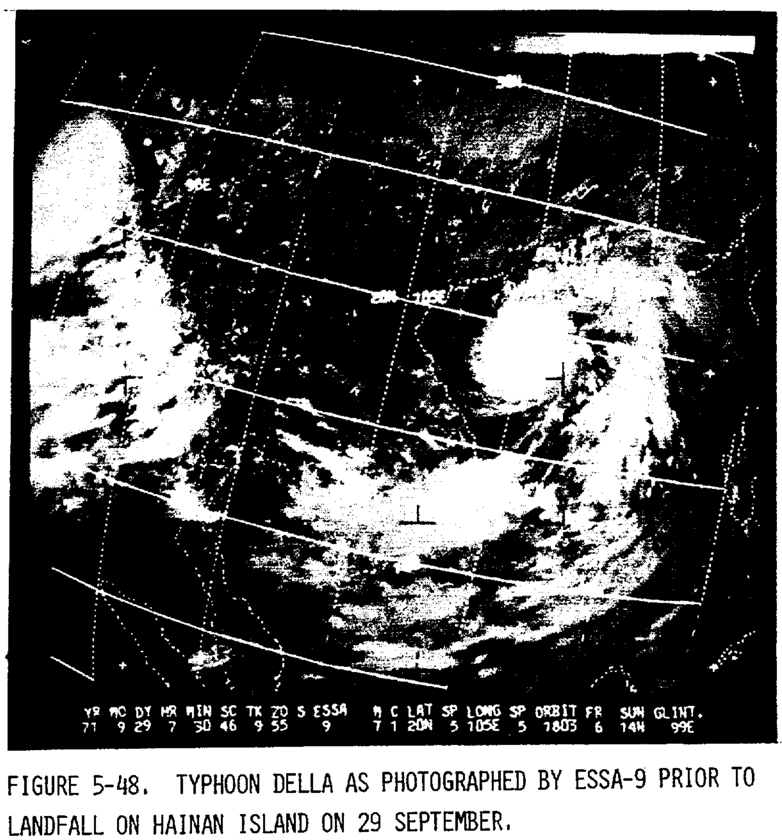


FIGURE 5-48. TYPHOON DELLA AS PHOTOGRAPHED BY ESSA-9 PRIOR TO LANDFALL ON HAINAN ISLAND ON 29 SEPTEMBER.

TYPHOON DELLA
EYE FIXES FOR CYCLONE NO. 32
27 SEP - 30 SEP 71

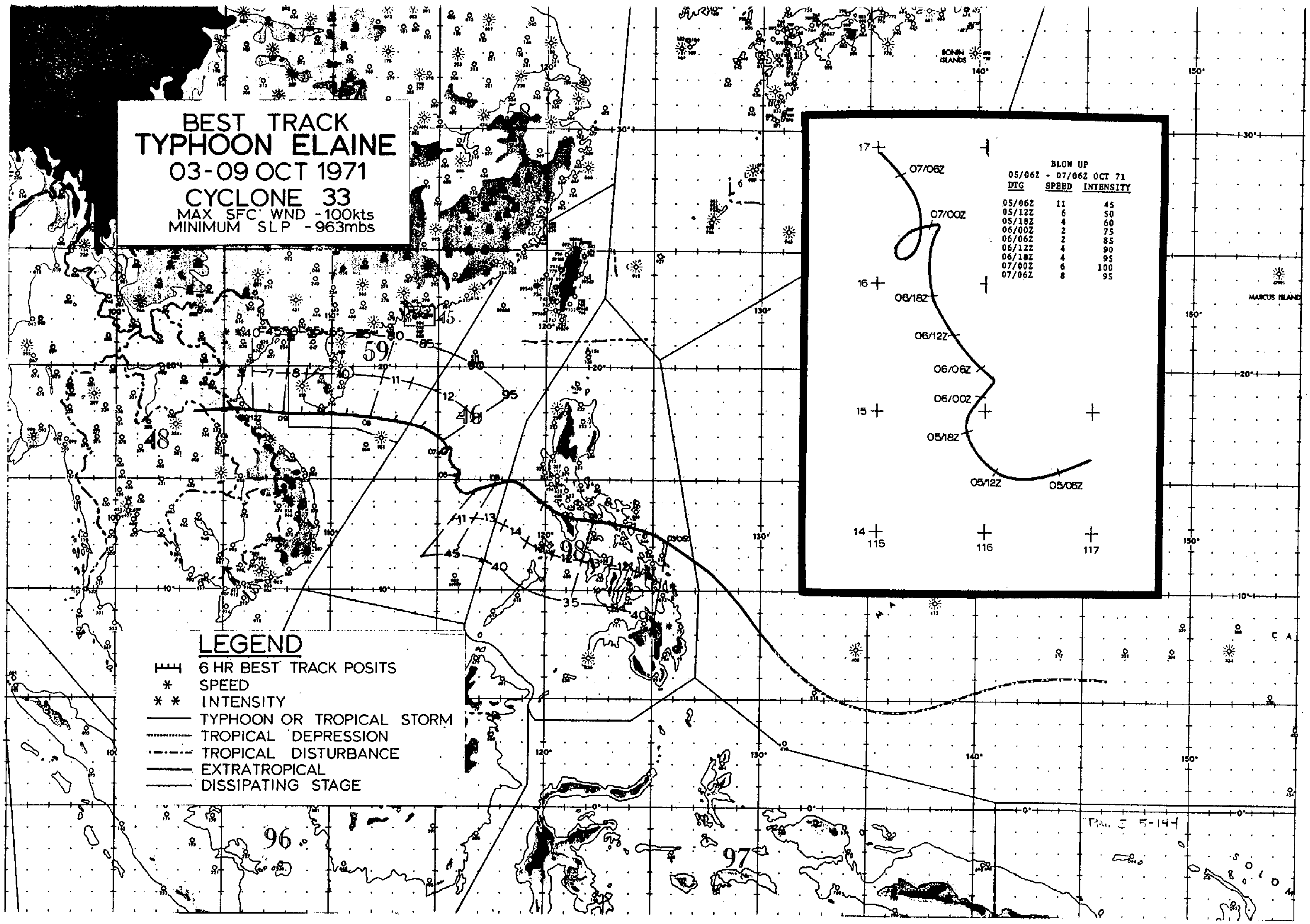
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	260630Z	16.0N 124.5E	SATELLITE---	STG C										FIRST BLTN	
2	270533Z	17.0N 121.5E	SATELLITE---	STG C											
3	271010Z	17.0N 120.4E	54-P- 4-15	500MB	25	----	----	----	-12/-8	----	------	--	--	NO RDR PRES	
4	271510Z	17.6N 119.6E	54-P- 5-10	500MB	35	----	----	----	-6/-8	----	------	--	--	POOR RDR PRES	
5	272221Z	18.7N 117.6E	VQ-P- 3- 4	------	----	60	995	----	26/24	CIRC		20	--	WC FRMNG F SEMIC	
6	280106Z	18.9N 117.0E	VQ-P- 3-15	------	----	----	----	----	--/--	CIRC		25	--	OPEN W SEMIC	19.7N 117.3E
7	280400Z	19.0N 116.3E	VQ-P- 3- 5	------	----	70	994	----	27/23	CIRC		30	--	BETTER ORGANIZED	
8	280632Z	19.0N 115.5E	SATELLITE---	STG X	DIA	2	CAT 3.0								
9	281015Z	19.0N 115.0E	54-P- 4- 2	700MB	65	65	987	2976	15/09	CIRC		15	--	OPEN W-700 CNTR 2NM W	
10	281305Z	19.1N 114.3E	54-P- 2- 5	700MB	65	----	988	2993	15/10	CIRC		20	--	CLSD WC	
11	281600Z	19.1N 113.8E	54-P- 2- 2	700MB	60	----	985	2957	14/08	CIRC		25	--	OPEN W SEMIC	
12	281610Z	19.1N 113.3E	54-P- 2- 2	700MB	60	----	981	2932	15/12	CIRC		25	--	OPEN W SEMIC	
13	282330Z	19.5N 112.2E	LND RDR---							----	------	--	--	FAIR FIX-VHHH	22.3N 114.2E
14	290300Z	19.5N 111.5E	LND RDR---							----	------	--	--	POOR FIX-VHHH	22.3N 114.2E
15	290731Z	19.0N 110.7E	SATELLITE---	STG X	DIA	3	CAT 3.5								

TYPHOON DELLA

0000Z 27 SEP TO 1200Z 30 SEP

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
270000Z	17.0N 122.2E	30	16.6N 122.2E	40	24	10	17.6N 117.8E	45	79	-10	18.5N 113.7E	55	97	-15	19.5N 109.7E	60	149	20
270600Z	17.4N 121.0E	25	16.8N 121.1E	35	36	10	17.8N 116.6E	50	79	-10	18.8N 112.6E	60	97	-5	--.- ---.-	--	--	--
271200Z	17.8N 119.8E	35	17.1N 120.0E	35	43	0	18.1N 115.6E	65	82	0	19.0N 111.5E	75	109	25	20.0N 107.5E	60	136	25
271800Z	18.4N 118.5E	45	17.6N 119.2E	40	62	-5	18.8N 114.7E	65	81	-5	20.0N 110.6E	70	153	25	--.- ---.-	--	--	--
280000Z	18.8N 117.2E	55	18.8N 117.2E	55	0	0	21.2N 112.4E	75	127	5	22.0N 107.3E	40	197	0	--.- ---.-	--	--	--
280600Z	19.0N 116.0E	60	19.3N 115.9E	65	19	5	20.9N 110.4E	70	117	5	22.1N 105.9E	35	192	-5	--.- ---.-	--	--	--
281200Z	19.1N 114.6E	65	19.2N 114.7E	70	8	5	20.0N 110.2E	70	85	20	20.8N 105.6E	40	92	5	--.- ---.-	--	--	--
281800Z	19.1N 113.3E	70	19.2N 113.3E	70	6	0	19.8N 108.6E	65	78	20	20.5N 104.4E	30	49	5	--.- ---.-	--	--	--
290000Z	19.1N 112.1E	70	19.1N 112.0E	75	6	5	19.5N 107.0E	55	49	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
290600Z	19.0N 110.9E	65	19.6N 110.9E	65	36	0	20.2N 106.3E	50	78	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291200Z	18.7N 109.6E	50	19.1N 109.9E	60	29	10	19.4N 105.2E	45	6	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
291800Z	18.5N 108.4E	45	19.1N 108.7E	60	40	15	19.7N 104.4E	30	11	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300000Z	18.7N 107.2E	40	19.1N 107.8E	50	41	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
300600Z	18.9N 106.2E	40	18.5N 106.8E	45	42	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301200Z	19.3N 105.2E	35	18.5N 105.5E	35	51	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
301800Z	19.7N 104.2E	25	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	29NM	78NM	134NM	142NM	30NM	73NM	123NM	142NM
AVERAGE RIGHT ANGLE ERROR	21NM	64NM	82NM	62NM	22NM	60NM	78NM	62NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	10KTS	11KTS	23KTS	5KTS	10KTS	11KTS	23KTS
AVERAGE BIAS OF WIND ERROR	4KTS	5KTS	4KTS	23KTS	5KTS	5KTS	4KTS	23KTS
NUMBER OF FORECASTS	13	11	7	2	15	12	8	2


BEST TRACK
TYPHOON ELAINE
03-09 OCT 1971
CYCLONE 33
MAX SFC WND -100kts
MINIMUM SLP -963mbs
BLOW UP
05/06Z - 07/06Z OCT 71
DTG SPEED INTENSITY
05/06Z 11 45
05/12Z 6 50
05/18Z 4 60
06/00Z 2 75
06/06Z 2 85
06/12Z 4 90
06/18Z 4 95
07/00Z 6 100
07/06Z 8 95
07/06Z
07/00Z
06/18Z
06/12Z
06/06Z
06/00Z
05/18Z
05/12Z
05/06Z
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BONIN ISLANDS
MARCUS ISLAND

Elaine became the second storm to reach typhoon force in the South China Sea within a week. A circulation was detected in the equatorial trough near Woleai Atoll in the central Carolines on the 28th. By the 30th, signs of development began to appear in satellite pictures as the disturbance passed south of the Palau Islands. Subsequent aircraft investigation of the system revealed the pre-Elaine system was still of depression status two days later. However, the circulation did develop to minimal tropical-storm strength shortly before she skirted the northern coast of Samar Island the evening of the 3rd (Figure 5-49).

Crossing the central Philippines at a 13-kt forward speed, Elaine exited south of Lubang Island 24 hours later. Extensive crop damage was reported to have been caused during the typhoon's transit of the islands. Maximum winds of 50 kt were registered at the Virac station on Catanduanes Island, while up to 7.8 inches of rainfall was recorded at Calapan on Mindoro. Calapan also measured the lowest pressure at 981.8 mb.

As an extension of a quasi-stationary trough in the Sea of Japan began to erode the subtropical ridge over South China, Elaine began to slow and stall west of Luzon. As the weak steering currents persisted, the storm drifted in a general northwestward direction at 4 kt and intensified to 100 kt (Figure 5-50). By the 7th, the ridge began to rebuild and Elaine swung back to a westerly track skirting southern Hainan early on October 9th. Dropping to tropical-storm status, Elaine traversed the Gulf of Tonkin, driving ashore on the Vietnamese coast north of Dong Hoi. She very quickly weakened and later dissipated completely over Laos.

During the time frame when Elaine stalled in the South China Sea, the envelope of gale force winds expanded in size to 300 n mi in radius with 50-kt winds extending 200 n mi in the southern quadrant. An extensive westerly fetch existing for several days caused huge waves to strike the western coastal region of the northern Philippines. Close to 10,000 persons had to be evacuated from the shore areas. Destruction due to the heavy seas amounted to 2,400 homes completely demolished.

The heavy seas were also responsible for a number of maritime casualties. The Philippine inter-island passenger ship MV TACLOBAN was sunk in the Tablas Straits with three persons reported killed. The pump boat SARANEL was capsized by big waves off the coast of Siguigas Island in the

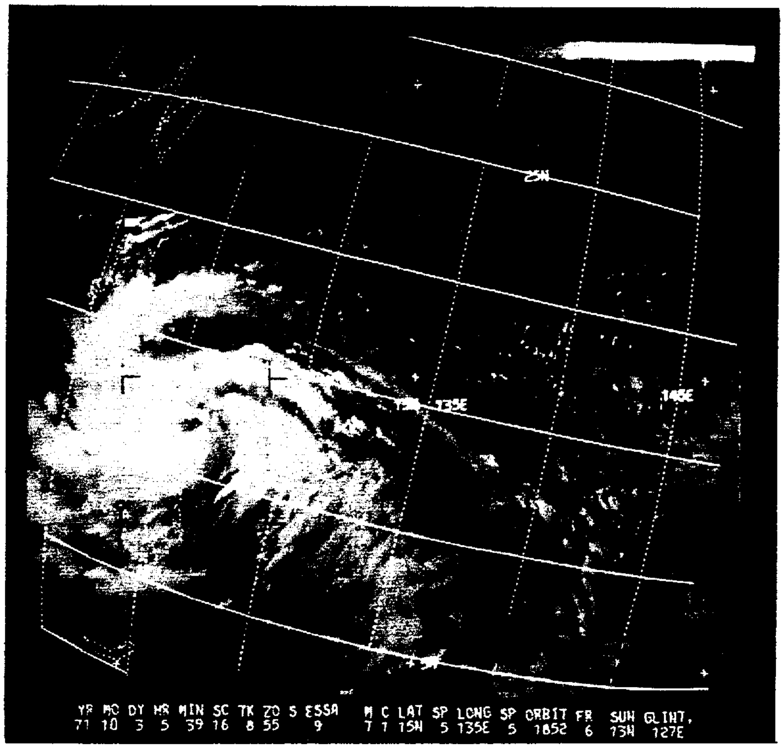


FIGURE 5-49. ELAINE ON 3 OCTOBER, VIEWED BY ESSA-9 AS THE TROPICAL STORM STRUCK SAMAR ISLAND IN THE CENTRAL PHILIPPINES.

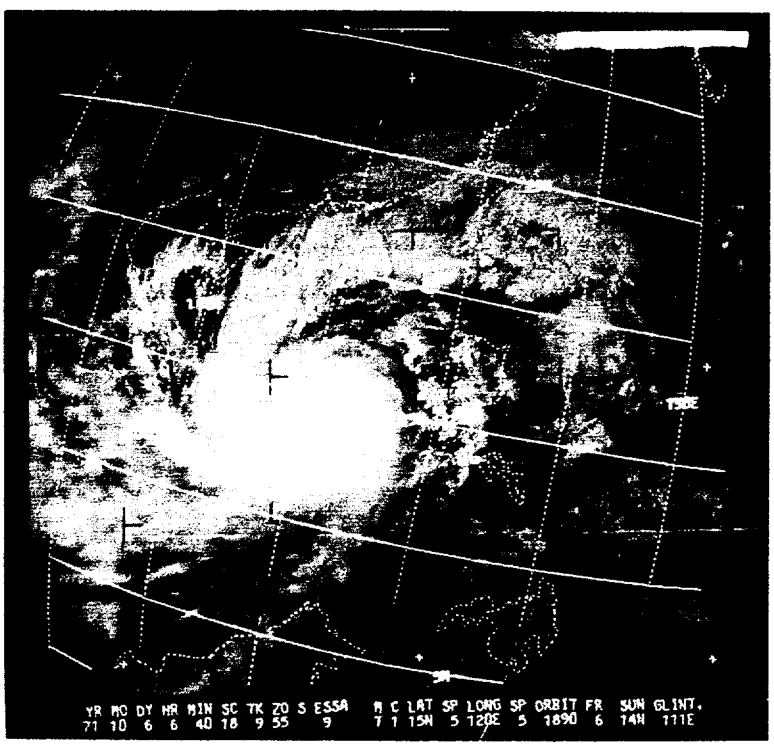


FIGURE 5-50. ESSA-9 PHOTO OF TYPHOON ELAINE ON 6 OCTOBER DURING HER QUASI-STATIONARY PERIOD WEST OF LUZON.

Mindano Sea with only four of its thirty passengers surviving. Immobilized south of the typhoon, the American ship STEEL VENDOR was run aground on the Loaita Bank in the South China Sea. In another incident, the sinking Panamanian tanker MV KEELUNG, some 240 n mi west of Manila, had to be abandoned by its crew in the heavy seas generated by Elaine.

TYPHOON ELAINE
EYE FIXES FOR CYCLONE NO. 33
03 OCT - 09 OCT 71

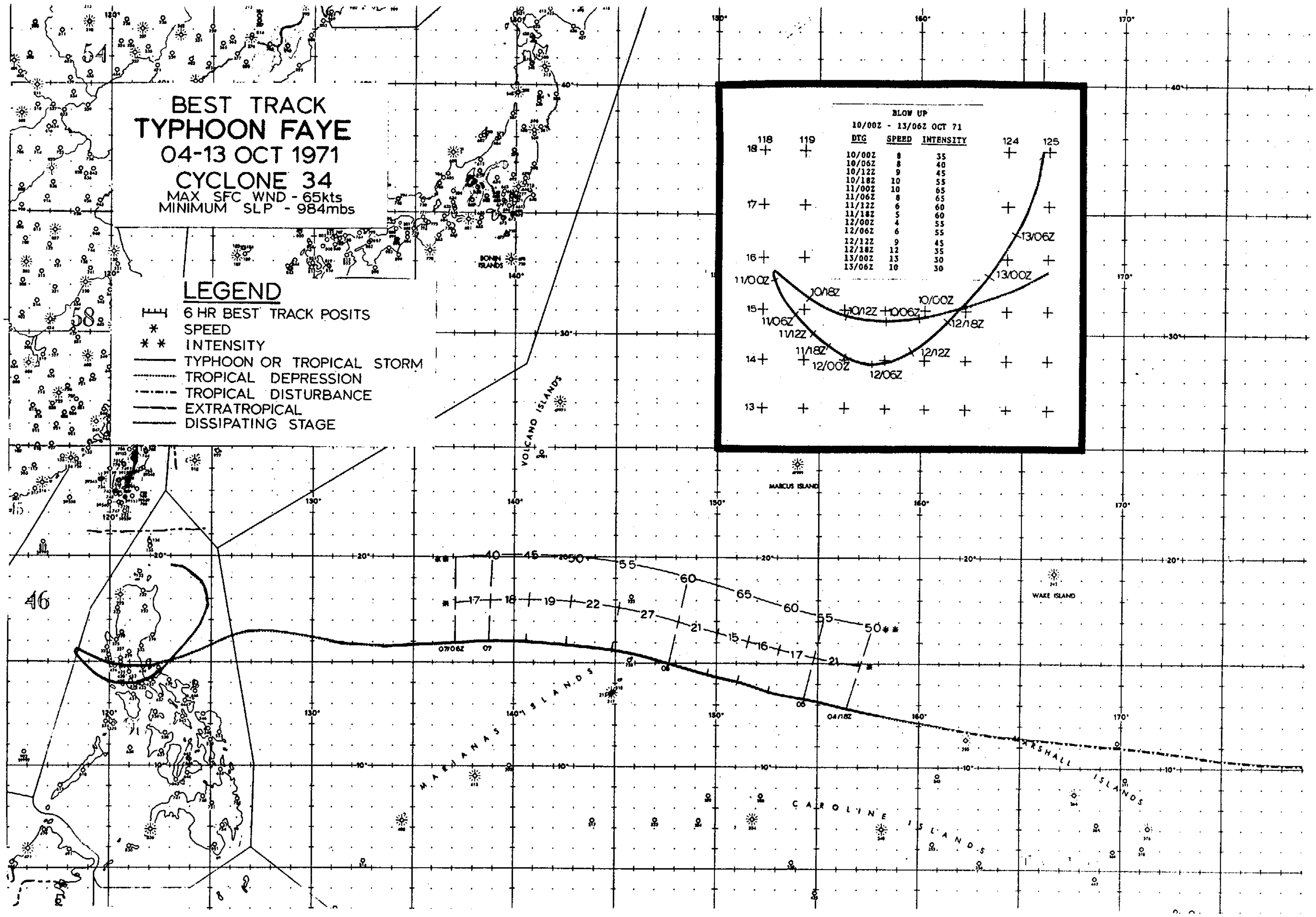
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	300630Z	7.0N 135.0E	SATELIT---	STG B										FIRST BLTN	
2	010537Z	11.0N 134.0E	SATELIT---	STG B										LITTLE CHG	
3	020632Z	11.0N 130.0E	SATELIT---	STG B											
4	030539Z	12.0N 126.0E	SATELIT---	STG C+										STRONGER	
5	031402Z	12.6N 124.4E	VQ-P- 2-18	700MB	----	----	993	3023	16/12	----	-----	--	--	RDR PRES V POOR	
6	031557Z	12.8N 124.3E	VQ-P- 3-12	700MB	----	----	993	3039	14/11	----	-----	--	--	RDR PRES POOR	
7	032200Z	13.0N 122.7E	54-P- 2-10	500MB	44	----	981	----	-6/-7	----	-----	--	--	NO RDR PRES	
8	040300Z	13.1N 121.3E	54-P- 4---	500MB	50	----	985	----	-4/-7	----	-----	--	--	NO RDR PRES	
9	040637Z	13.0N 121.0E	SATELIT---	STG X	DIA	5 CAT	2.0							NO EYE VISIBLE	
10	041015Z	12.9N 120.2E	54-P- 2-10	500MB	18	----	----	----	-7/-8	----	-----	--	--	POOR RDR PRES	
11	041614Z	14.5N 119.5E	54-P- 3-15	500MB	40	----	991	----	-6/-6	----	-----	--	--	POOR RDR PRES	
12	042213Z	15.2N 117.9E	VQ-R-15---	-----	----	----	----	----	--/--	CIRC		14	--	OPEN E SEMIC	16.2N 117.5E
13	050358Z	14.5N 116.9E	VQ-P-10---	-----	----	45	980	----	26/25	CIRC		14	--	OPEN N AND S	
14	050737Z	14.5N 116.0E	SATELIT---	STG X	DIA	4 CAT	2.0								
15	051000Z	14.4N 116.4E	54-P- 2- 2	700MB	45	50	963	2896	15/14	CIRC		10	--	OPEN NW-NE-700	
														CNTR 5NM SW	
16	051540Z	14.4N 116.7E	54-P- 2- 3	700MB	70	----	975	2896	18/17	CIRC		10	--	PORTION OF WC TO	
17	052205Z	15.0N 115.9E	54-P- 2- 3	700MB	40	75	969	2829	18/17	CIRC		18	--	POOR RDR PRES-700	
														CNTR 5NM SE	
18	060100Z	15.1N 116.0E	54-P- 3- 4	700MB	55	65	974	2841	17/15	CIRC		18	--	CLSD WC	
19	060404Z	15.1N 116.1E	54-P- 2- 3	700MB	72	120	968	2838	16/14	CIRC		20	--	WC OPEN N	
20	060640Z	15.8N 116.0E	SATELIT---	STG X	DIA	5 CAT	3.0							FAINT EYE VISIBLE	
21	060850Z	14.8N 116.4E	VQ-P- 3-15	-----	----	105	----	----	26/21	CIRC		35	--	RDR PRES CONFUSED	
22	061000Z	15.4N 115.9E	VQ-P-10- 1	700MB	----	----	977	2886	18/13	CIRC		10	--	NO WC	
23	061204Z	15.3N 116.2E	VQ-R-10---	-----	----	----	----	----	--/--	CIRC		10	--	OPEN N	16.5N 117.0E
24	061620Z	16.0N 115.4E	54-P- 2- 3	700MB	75	----	960	2771	18/15	ELIP	SE-NW	50X30	--	OPEN SE-700 CNTR	
														4NM N	
25	061830Z	16.2N 115.4E	54-P- 2- 4	700MB	80	----	964	2777	16/14	ELIP	SE-NW	50X30	--	FAIR RDR PRES	
26	062330Z	16.4N 115.6E	54-P- 2- 2	700MB	85	100	957	2789	16/13	CIRC		60	--	WC DSPTG-700 CNTR	
														14NM W	
27	070130Z	16.3N 115.2E	54-P- 5-15	700MB	40	85	963	2774	16/15	CIRC		20	--	CLSD WC-700 CNTR	
														12NM NW	
28	070400Z	16.5N 115.3E	54-P- 4---	700MB	47	90	964	2786	19/17	CIRC		15	--	WC OPEN SE-700	
														CNTR 9NM W	
29	070739Z	17.0N 115.0E	SATELIT---	STG X	DIA	5 CAT	3.5							LITTLE CHANGE	
30	071043Z	17.2N 114.6E	VQ-P-10---	700MB	----	----	967	2847	--/--	----	-----	--	--	V POOR RDR PRES	
														2ND CNTR 42NM SE	
31	071300Z	17.0N 114.6E	VQ-R-20---	-----	----	----	----	----	--/--	----	-----	--	--	WELL ORGANIZED	18.2N 114.8E
32	071557Z	17.3N 113.4E	VQ-P-10---	700MB	----	----	966	2829	18/13	CIRC		40	--	HOLE IN RDR RETRN	
33	072230Z	17.2N 112.5E	54-P- 8-15	700MB	80	----	----	2810	18/16	----	-----	--	--	POOR FIX	
34	080345Z	16.8N 110.9E	54-P-10-14	700MB	80	65	----	----	14/11	----	-----	--	--	POOR FIX	
35	080642Z	18.0N 110.5E	SATELIT---	STG X	DIA	4 CAT	3.0							WEAKER	
36	080645Z	17.7N 110.5E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
37	081215Z	17.9N 109.9E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
38	081315Z	17.8N 109.8E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
39	081415Z	17.9N 109.6E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
40	081445Z	17.8N 109.5E	LND RDR---							----	-----	--	--	DANANG RDR	16.0N 108.2E
41	090740Z	18.0N 107.0E	SATELIT---	STG C+											

TYPHOON ELAINE

0600Z 3 OCT TO 1200Z 9 OCT

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORFCAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS	
	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
030600Z	12.1N	125.7E	40	11.7N	124.4E	30	80	-10	13.6N	119.9E	40	68	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--
031200Z	12.6N	124.7E	40	12.8N	124.5E	45	17	5	14.8N	120.5E	50	64	10	16.5N	116.3E	70	120	20	18.1N	112.0E	75	259	-15
031800Z	12.9N	123.6E	35	12.9N	124.0E	45	23	10	14.8N	120.4E	50	81	10	16.5N	116.2E	70	97	5	--.-	---.-	--	--	--
040000Z	13.1N	122.3E	35	13.4N	122.5E	45	21	10	15.2N	117.4E	70	25	25	16.2N	113.5E	75	158	0	16.9N	109.5E	70	339	-30
040600Z	13.2N	121.0E	35	13.1N	120.5E	55	30	20	14.6N	114.9E	75	105	30	15.8N	110.6E	70	312	-15	--.-	---.-	--	--	--
041200Z	13.9N	119.9E	40	13.0N	119.9E	60	54	20	14.6N	115.2E	80	52	30	15.8N	110.9E	75	276	-15	16.8N	106.9E	50	412	-40
041800Z	14.8N	119.0E	40	14.4N	119.8E	60	52	20	16.3N	114.7E	80	108	15	17.4N	110.0E	75	327	-20	--.-	---.-	--	--	--
050000Z	14.9N	117.7E	45	15.2N	117.9E	65	21	20	16.8N	112.9E	80	205	5	17.5N	108.4E	70	405	-30	19.0N	104.7E	40	415	-40
050600Z	14.4N	116.7E	45	14.8N	116.5E	65	27	20	16.3N	112.0E	75	238	-10	17.4N	108.1E	70	408	-25	--.-	---.-	--	--	--
051200Z	14.5N	116.1E	50	14.7N	116.0E	60	13	10	16.0N	111.6E	60	237	-30	17.4N	107.8E	55	359	-35	19.2N	104.5E	35	305	-30
051800Z	14.9N	115.9E	65	14.5N	116.7E	60	52	-5	15.4N	113.5E	60	119	-35	16.5N	110.4E	55	157	-30	--.-	---.-	--	--	--
060000Z	15.1N	116.0E	75	15.0N	116.0E	85	6	10	15.2N	115.0E	100	75	0	16.0N	111.8E	95	102	15	17.0N	108.7E	80	79	30
060600Z	15.3N	116.0E	85	15.1N	116.1E	105	13	20	15.3N	114.8E	105	87	10	16.0N	111.5E	95	115	20	--.-	---.-	--	--	--
061200Z	15.6N	115.7E	90	15.4N	115.8E	105	13	15	15.7N	113.8E	100	97	10	16.4N	110.6E	90	103	25	17.5N	107.5E	80	69	40
061800Z	15.9N	115.5E	95	16.0N	115.2E	100	18	5	16.5N	112.4E	95	72	10	17.4N	109.3E	85	45	30	--.-	---.-	--	--	--
070000Z	16.4N	115.4E	100	16.4N	115.4E	100	0	0	17.3N	114.2E	80	133	0	18.6N	112.7E	70	280	20	--.-	---.-	--	--	--
070600Z	16.7N	115.2E	95	16.6N	115.1E	95	8	0	17.8N	113.7E	85	165	10	19.1N	112.2E	75	296	30	--.-	---.-	--	--	--
071200Z	17.3N	114.1E	90	17.0N	114.8E	95	44	5	18.2N	113.2E	85	200	20	19.4N	111.6E	75	306	35	--.-	---.-	--	--	--
071800Z	17.6N	112.9E	85	17.4N	113.1E	90	17	5	18.4N	109.0E	70	34	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
080000Z	17.7N	111.9E	80	17.4N	112.0E	85	19	5	17.8N	107.9E	65	13	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
080600Z	17.8N	110.8E	75	17.7N	110.7E	80	8	5	18.5N	106.6E	60	41	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--
081200Z	17.9N	109.7E	65	17.9N	109.7E	75	0	10	18.7N	105.7E	50	58	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--
081800Z	17.9N	108.7E	55	17.9N	108.8E	70	6	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
090000Z	18.0N	107.8E	50	18.0N	107.8E	65	0	15	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
090600Z	18.0N	107.1E	45	18.1N	106.8E	55	18	10	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--
091200Z	18.0N	106.4E	40	18.2N	106.2E	45	16	5	--.-	---.-	--	--	--	--.-	---.-	--	--	--	--.-	---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORFCAST ERROR	22NM	103NM	227NM	268NM	22NM	103NM	227NM	268NM
AVERAGE RIGHT ANGLE ERROR	13NM	63NM	70NM	69NM	13NM	63NM	70NM	69NM
AVERAGE MAGNITUDE OF WIND ERROR	11KTS	15KTS	22KTS	32KTS	11KTS	15KTS	22KTS	32KTS
AVERAGE BIAS OF WIND ERROR	9KTS	8KTS	2KTS	-12KTS	9KTS	8KTS	2KTS	-12KTS
NUMBER OF FORECASTS	26	22	17	7	26	22	17	7


BEST TRACK
TYPHOON FAYE
04-13 OCT 1971
CYCLONE 34
MAX SFC WND - 65kts
MINIMUM SLP - 984mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
BLOW UP
10/00Z - 13/06Z OCT 71
DTG SPEED INTENSITY
10/00Z 8 35
10/06Z 8 40
10/12Z 9 45
10/18Z 10 55
11/00Z 10 65
11/06Z 8 65
11/12Z 6 60
11/18Z 5 60
12/00Z 4 55
12/06Z 6 55
12/12Z 9 45
12/18Z 12 35
13/00Z 13 30
13/06Z 10 30
BONIN ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARIANAS ISLANDS
MARSHALL ISLANDS
CAROLINE ISLANDS

FAYE

Faye was first sighted as a weak entity in satellite pictures south of Johnson Island as early as September 27th. Ill-defined, the system drifted west-northwest for a week making passage near Eniwetok on the 3rd as the U.S. Coast Guard station on the atoll reported a sharp wind shift. By the 4th, satellite pictures detected signs of organization in the cloudiness. An aircraft investigation early the following morning located a tropical storm with 50-kt peak winds some 700 n mi east of the Marianas (Figure 5-51).

As a high cell began to build north of Marcus Island, Faye sailed along at 16 to 21 kt, briefly reaching typhoon strength late on the 5th. Returned to tropical-storm classification, Faye passed just north of Saipan the following afternoon. A strong band of wind associated with the storm was located across the north semicircle. The U.S. Coast Guard station on Saipan, which was south of the center, recorded only southwesterly winds at 15 kt during passage.

Faye continued on a westerly heading during the next 24 hours gradually weakening and appearing to dissipate late on the 7th. With a rather complex circulation pattern in the Philippine Sea at this time, it is possible that the system may have been absorbed in a larger circulation to the south. However, for the two-day period of October 8th and 9th, all available reconnaissance, surface and satellite data indicate a considerable amount of uncertainty in this portion of Faye's track. Redevelopment over the Philippines may possibly not have been retraceable to the initial system.

After regaining minimal storm strength on the 9th in the Lamon Bay region, Faye crossed Luzon on a westerly track north of Manila. Once in the South China Sea, she intensified to typhoon strength (Figure 5-52) but then grinded to a halt on the 11th 45 n mi northeast of Scarborough Shoals. With the deepening of a trough in the westerlies extending from Korea to Taiwan, steering currents were initially weak, then as the northwesterly flow behind the trough began to take hold, Faye began to track southeastward.

Commencing a highly unusual track, Faye cut across Luzon for the second time, by then weakened to tropical-storm force. The storm passed south of Manila, then into Lamon Bay after being greatly modified by the northerly flow.

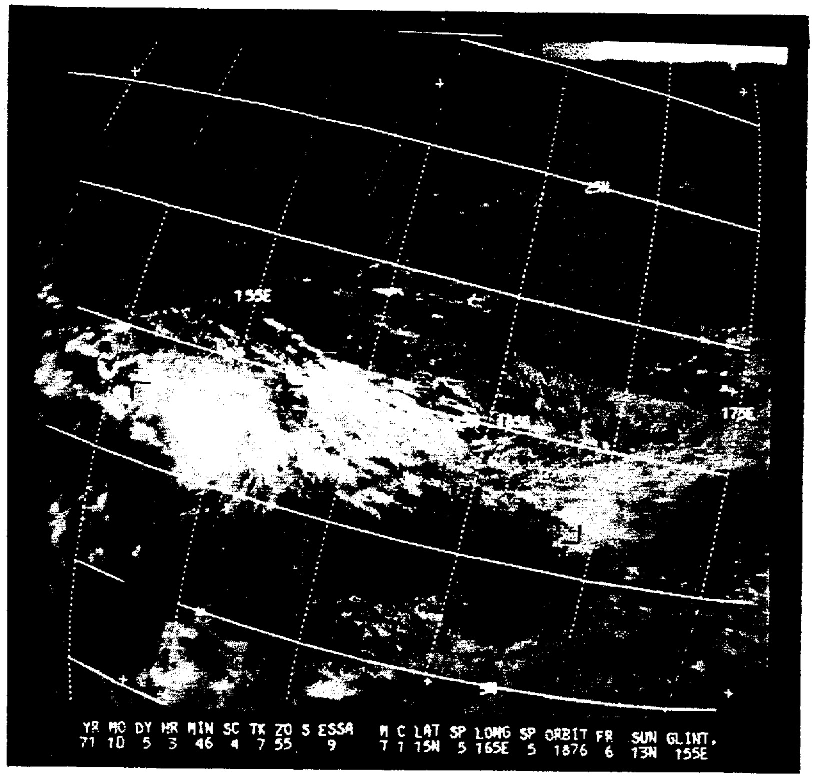


FIGURE 5-51. ESSA-9 PHOTO OF TROPICAL STORM FAYE EAST OF THE MARIANAS ON 5 OCTOBER.

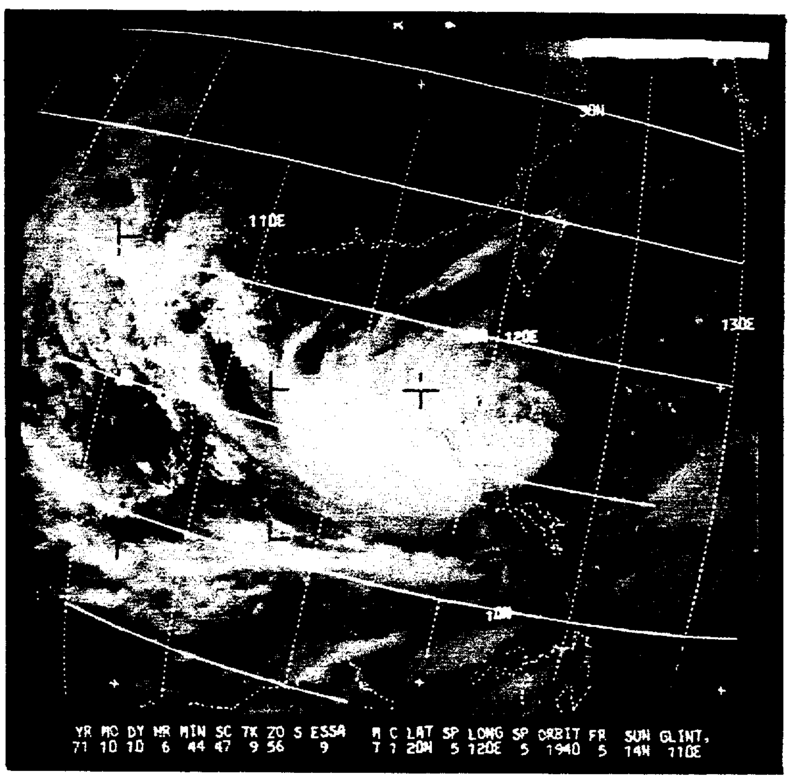


FIGURE 5-52. TYPHOON FAYE WEST OF LUZON ON 10 OCTOBER.

Highest winds reported during Faye's transit were 42 kt at Calapan on northern Mindoro. Now on the eastern side of the southern extension of the trough near the Taiwan Straits, the remains of Faye slowly moved northeastward acquiring extratropical characteristics as she merged with a weak frontal zone south of the Ryukyus.

The effect of Faye on the city of Manila was considerable as heavy rains flooded much of its low-lying areas. The torrential rainfall from Faye in combination with that of tropical storm Gloria, which struck northern Luzon late on the 10th, was responsible for measured 24-hour amounts up to 10.78 inches at Casiguran. Flooding caused evacuation of many towns in Luzon leaving thousands homeless. Streams already swollen by rains from typhoon Elaine overflowed their banks sweeping away bridges and submerging crops and homes. At least 13 deaths with an additional 80 persons counted as missing were reported in the aftermath of Gloria and Faye. Offshore, the heavy seas generated by Faye forced the inter-island vessel MV JOLO aground near Corregidor at the mouth of Manila Bay, while in Palawan Island a pump boat was reported to have sunk with one of its eleven crew men counted as missing.

TYPHOON FAYE
EYE FIXES FOR CYCLONE NO. 34
04 OCT - 13 OCT 71

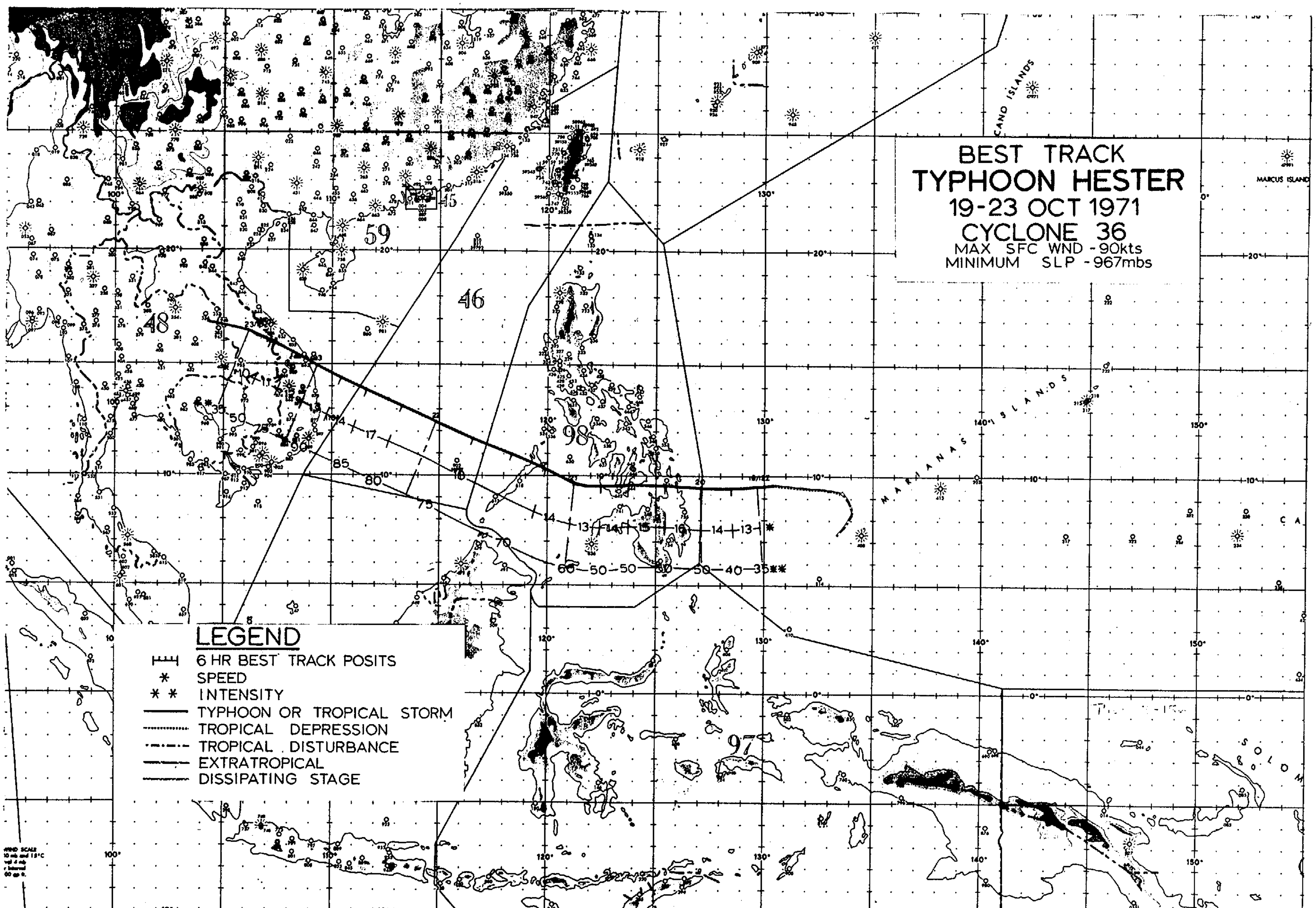
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	040442Z	12.0N 158.0E	SATELLITE--	STG C										FIRST BLTN	
2	041920Z	12.3N 156.0E	VO-P- 5-10	-----	----	55	992	----	26/24	ELIP	SE-NW	27X16	3	WC OPEN NW	
3	042315Z	12.8N 155.5E	VO-R-15-10	-----	----	65	----	----	--/--	CIRC		1	8	POOR FIX	13.6N 158.0E
4	050346Z	12.5N 155.0E	SATELLITE--	STG C										STRONGER	
5	050410Z	13.3N 152.8E	54-P- 5- 5	700MB	32	60	981	3024	16/13	CIRC		10	--	POORLY DEFINED	
6	050910Z	13.8N 151.6E	54-P- 3- 7	700MB	40	65	992	3060	15/12	CIRC		10	--	POORLY DEFINED	
7	051550Z	14.3N 150.1E	VO-P- 5- 3	-----	----	70	993	----	27/23	CIRC		10	3	SMALL WIND EYE	
8	051900Z	14.5N 148.3E	VO-R- 7- 2	-----	----	----	----	----	--/--	----	-----	--	--	NO WC	14.2N 148.7E
9	052145Z	14.7N 146.4E	VO-P- 5- 1	-----	----	75	992	----	27/24	CIRC		1	--	NO WC	
10	060004Z	15.5N 145.0E	SATELLITE--	STG C										WEAKER	
11	060033Z	15.6N 144.4E	54-P- 3- 5	400M	40	60	994	----	25/23	----	-----	--	--	NO WC	
12	060933Z	15.9N 143.3E	VO-P-10- 3	-----	----	55	990	----	28/24	CIRC		8	--	NO WC	
13	061521Z	16.1N 141.5E	VO-P- 3---	-----	----	55	990	----	27/24	CIRC		5	--		
14	062230Z	15.9N 139.2E	54-P- 5-10	700MB	30	40	1000	3069	14/11	CIRC		30	--	POORLY DEFINED	
15	070336Z	16.3N 138.0E	54-P- 3- 5	700MB	20	30	999	3072	14/10	CIRC		30	--	POORLY DEFINED	
16	070543Z	16.0N 138.0E	SATELLITE--	STG C											
17	071530Z	15.9N 135.0E	VO-R- 3- 2	-----	----	----	----	----	--/--	CIRC		2	8	CLSD WC	16.3N 135.0E
18	080643Z	16.0N 131.0E	SATELLITE--	STG B										WEAKER	
19	090544Z	16.5N 127.5E	SATELLITE--	STG C											
20	100644Z	17.0N 121.0E	SATELLITE--	STG C										STRONGER	
21	101600Z	15.0N 119.5E	54-P- 1---	500MB	60	----	----	2709	00/01	----	-----	--	--	POORLY DEFINED	
22	102230Z	15.7N 118.2E	54-P-10- 5	700MB	35	45	984	2920	18/16	CIRC		25	--	POORLY DEFINED 700 CNTR 10NM SW	
23	110110Z	15.3N 118.6E	54-P- 5- 5	700MB	60	70	----	2929	16/14	ELIP	N-S	40X25	--	NO WC	
24	110548Z	15.0N 118.0E	SATELLITE--	STG B										LITTLE CHANGE	
25	110800Z	15.0N 118.7E	54-P- 2---	700MB	30	35	984	2935	16/16	----	-----	--	--	NO WC-700 CNTR 10NM S	
26	111209Z	14.5N 119.2E	54-P- 2-13	700MB	55	----	985	2966	15/14	----	-----	--	--	NO WC	
27	111600Z	14.3N 119.6E	54-P- 2- 8	700MB	60	----	985	2954	16/13	CIRC		20	--	POORLY DEFINED	
28	111615Z	14.5N 119.1E	SHP RDR---							----	-----	--	--	PSBL CNTR	
29	111800Z	14.4N 119.7E	SHP RDR---							----	-----	--	--	PSBL CNTR	
30	111900Z	14.4N 119.6E	SHP RDR---							----	-----	--	--	PSBL CNTR	
31	112000Z	14.3N 119.7E	SHP RDR---							----	-----	--	--	PSBL CNTR	
32	112100Z	14.2N 119.9E	SHP RDR---							----	-----	--	--	PSBL CNTR	
33	112140Z	14.2N 119.9E	54-P- 2- 5	700MB	60	----	980	2963	14/12	CIRC		20	--	POORLY DEFINED	
34	112200Z	14.2N 119.9E	SHP RDR---							----	-----	--	--	PSBL CNTR	
35	120045Z	14.0N 120.1E	54-P- 2- 5	700MB	38	40	----	2978	15/11	CIRC		15	--	POORLY DEFINED 700 CNTR 6NM W	
36	120300Z	13.9N 120.4E	54-P- 1- 4	700MB	55	65	988	2984	15/09	CIRC		20	--	WC FORMING-700 CNTR 5NM WNW	
37	120646Z	14.5N 120.0E	SATELLITE--	STG C										LITTLE CHANGE	
38	121000Z	14.1N 119.7E	54-P- 3-12	500MB	60	----	----	2790	04/03	CIRC		20	--	POORLY DEFINED	
39	121615Z	14.7N 119.4E	54-P- 5-20	500MB	40	----	----	2820	03/04	CIRC		20	--	POORLY DEFINED	

TYPHOON FAYE

1800Z 4 OCT TO 0600Z 13 OCT

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
041800Z	12.8N 156.4E	50	12.7N 155.0E	45	82	-5	13.7N 150.3E	65	58	0	14.5N 145.5E	85	296	40	--.- ---.-	--	--	--
050000Z	13.2N 154.3E	55	12.9N 154.0E	60	25	5	13.7N 149.4E	80	126	20	14.5N 145.0E	100	368	60	--.- ---.-	--	--	--
050600Z	13.6N 152.6E	60	13.3N 152.4E	60	21	0	14.3N 147.0E	85	144	30	15.2N 142.2E	105	297	65	--.- ---.-	--	--	--
051200Z	14.0N 151.0E	65	13.7N 150.9E	60	19	-5	14.6N 145.7E	70	195	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
051800Z	14.4N 149.6E	65	14.4N 149.7E	65	6	0	15.9N 144.5E	80	224	35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060000Z	14.9N 147.6E	60	14.9N 147.8E	70	12	10	17.0N 142.0E	90	193	50	--.- ---.-	--	--	--	--.- ---.-	--	--	--
060600Z	15.6N 144.9E	55	15.6N 144.3E	50	35	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061200Z	15.9N 142.6E	50	16.1N 142.5E	50	13	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
061800Z	16.0N 140.6E	45	16.2N 140.7E	50	13	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070000Z	16.0N 138.8E	40	16.0N 138.7E	35	6	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
070600Z	16.0N 137.1E	40	16.3N 137.4E	30	25	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
100000Z	14.9N 121.8E	35	15.3N 121.8E	40	24	5	15.6N 117.3E	70	58	5	16.1N 113.2E	80	410	25	16.8N 109.4E	70	817	40
100600Z	14.8N 121.0E	40	15.3N 121.2E	35	32	-5	15.6N 117.0E	70	112	5	16.1N 113.3E	80	447	25	--.- ---.-	--	--	--
101200Z	14.9N 120.1E	45	15.4N 119.9E	55	32	10	15.8N 115.8E	80	216	20	16.2N 112.1E	90	562	45	--.- ---.-	--	--	--
101800Z	15.3N 119.1E	55	15.1N 119.2E	60	13	5	15.4N 115.0E	85	275	25	15.8N 111.3E	90	654	55	--.- ---.-	--	--	--
110000Z	15.6N 118.3E	65	15.5N 118.0E	60	18	-5	15.9N 113.9E	85	368	30	16.6N 110.2E	75	771	45	--.- ---.-	--	--	--
110600Z	14.9N 118.8E	65	15.6N 116.9E	65	117	0	16.1N 112.9E	85	469	30	16.8N 109.2E	70	858	40	--.- ---.-	--	--	--
111200Z	14.5N 119.3E	60	15.0N 118.7E	60	46	0	15.2N 117.7E	50	235	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
111800Z	14.2N 119.6E	60	14.3N 119.9E	55	18	-5	16.1N 122.4E	40	84	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
120000Z	14.1N 120.0E	55	14.2N 120.0E	55	6	0	14.6N 120.1E	50	212	20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
120600Z	13.9N 120.7E	55	13.9N 120.6E	60	6	5	14.5N 120.6E	45	239	15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
121200Z	14.1N 121.6E	45	14.2N 120.7E	45	52	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
121800Z	14.7N 122.6E	35	14.6N 121.6E	40	58	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
130000Z	15.7N 123.6E	30	15.5N 123.3E	30	21	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
130600Z	16.5N 124.2E	30	16.3N 124.1E	30	13	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORFCAST ERROR	30NM	197NM	434NM	0NM	29NM	201NM	518NM	817NM
AVERAGE RIGHT ANGLE ERROR	18NM	106NM	216NM	0NM	17NM	97NM	290NM	515NM
AVERAGE MAGNITUDE OF WIND ERROR	4KTS	20KTS	45KTS	0KTS	4KTS	20KTS	44KTS	40KTS
AVERAGE BIAS OF WIND ERROR	0KTS	20KTS	45KTS	0KTS	0KTS	20KTS	44KTS	40KTS
NUMBER OF FORECASTS	23	14	7	0	25	16	9	1


BEST TRACK
TYPHOON HESTER
19-23 OCT 1971
CYCLONE 36
MAX SFC WND -90kts
MINIMUM SLP -967mbs
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
MARIANAS ISLANDS
MARCUS ISLAND

HESTER

One of the most devastating typhoons to strike Vietnam in over a decade developed from a circulation just west of the Palau Islands. Hester attained tropical-storm strength late on the 19th (Figure 5-53) about 250 miles east of northern Mindanao. The storm swung to the west-northwest crossing the Visayas and intensifying to typhoon force in the Sulu Sea on the 21st. Later that evening, Hester cut across northern Palawan Island and moved into the South China Sea, leaving behind some six persons killed and two missing in the southern Philippines. Winds of 50 kt were felt at Cebu City as the storm center passed 40 n mi south of the station during the evening of the 20th.

As a strong ridge built along the South China mainland, Hester accelerated to 18 kt in forward speed on her west-northwest course or twice the climatological average for typhoons in that region during October. Hester continued to intensify to 90 kt during her day-and-a-half track across the South China Sea (Figure 5-54). Arriving ashore on the Vietnamese coast during the morning of the 23rd, the typhoon's eye passed just south of Hue and diminished in strength. The storm rapidly dissipated over central Laos that evening.

Maximum sustained winds at DaNang were registered at 60 kt with gusts to 85 kt during Hester's passage. Maximum gusts of 70 and 71 kt were reported at Camp Eagle and Hue respectively. The lowest pressure of 971 mb was measured at Chu Lai where maximum winds of 70 kt gusting to 90 kt were estimated.* Heaviest rainfall measured was at Camp Eagle with 5.44 inches.

Extensive damage was suffered at American bases including Camp Eagle and the air and naval facilities at DaNang. Heaviest hit was Chu Lai with 75% of its structures receiving damage. Thirty-eight helicopters were destroyed, four hangers collapsed while eighty-seven other aircraft, mostly helicopters, received damage. Three American lives were lost due to the flying debris (Figures 5-55 and 5-56).

Over 200 n mi of coastal areas were flooded from Quang-tri to DaNang while 90% damage was sustained to houses in Quang Ngai. Severe damage to crops was reported

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*Based on data supplied by 1st Weather Group, USAF, Saigon, Vietnam.

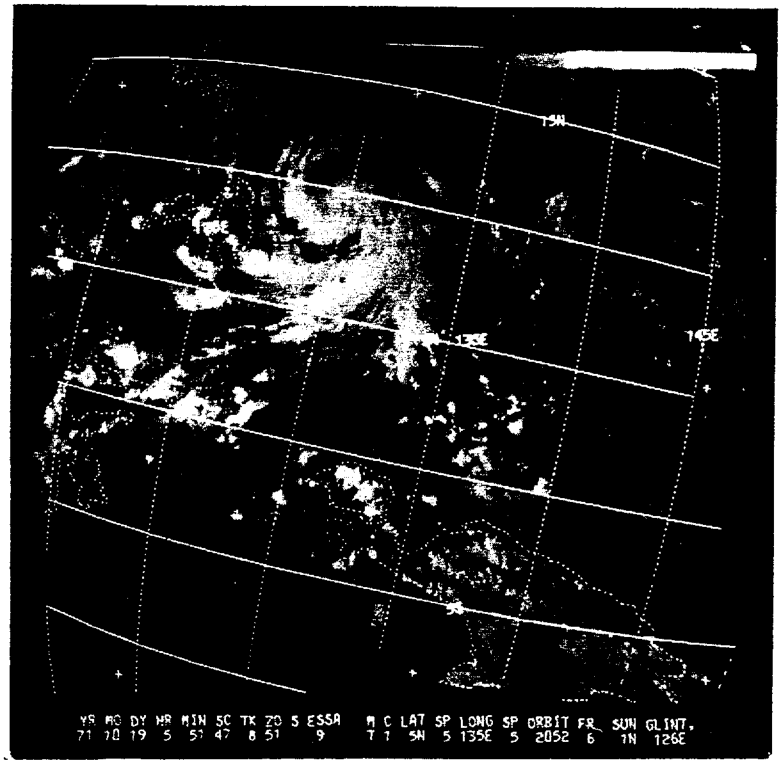


FIGURE 5-53. ESSA-9 PHOTO OF HESTER AS A DEVELOPING TROPICAL STORM EAST OF MINDANAO ON 19 OCTOBER.

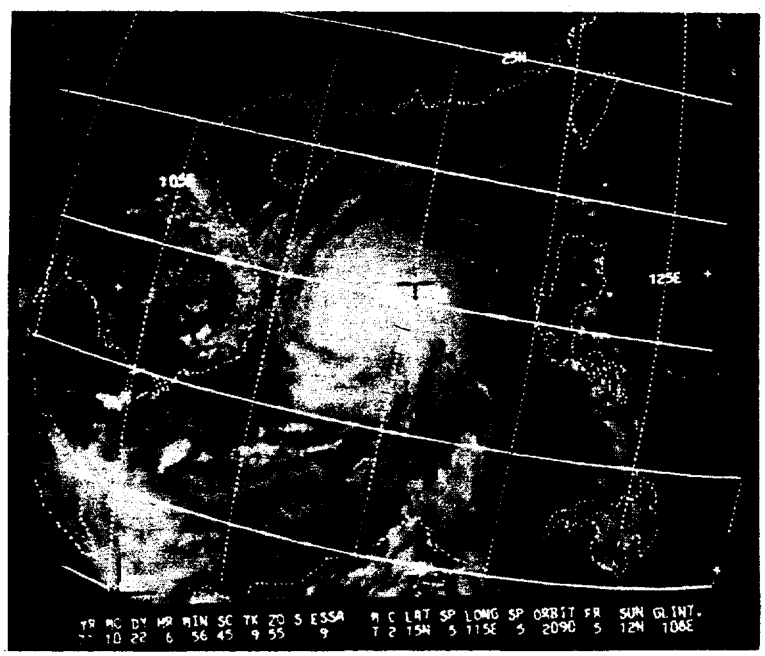


FIGURE 5-54. TYPHOON HESTER IN THE SOUTH CHINA SEA AS VIEWED BY ESSA-9 ON 22 OCTOBER.

and loss of cattle amounted to close to 900 head. Maritime casualties accounted for some 500 fishing boats reported sunk or destroyed and the 1,000-ton UNION PACIFIC run aground north of Chu Lai.

In total, newspaper reports indicate some 85 Vietnamese were killed and over 200,000 rendered homeless due to Hester. The Republic of Vietnam social welfare department regarded the typhoon as the worst to strike the country since 1944.

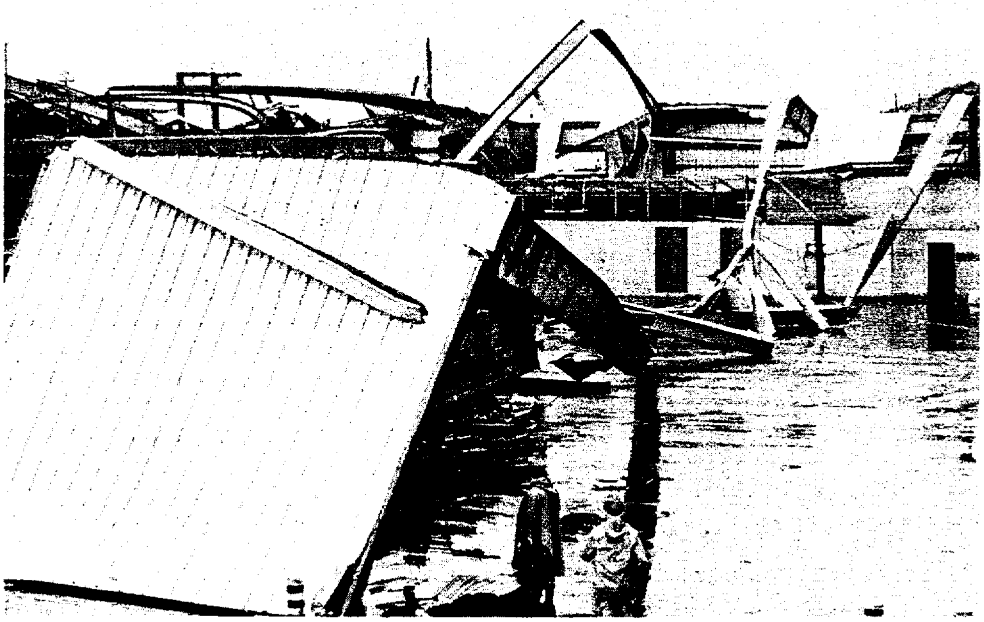


FIGURE 5-55. (TOP AND BOTTOM) DAMAGE SUSTAINED BY HANGERS AT THE CHU LAI INSTALLATION, VIETNAM--COURTESY CORPS OF ENGINEERS U.S.A.

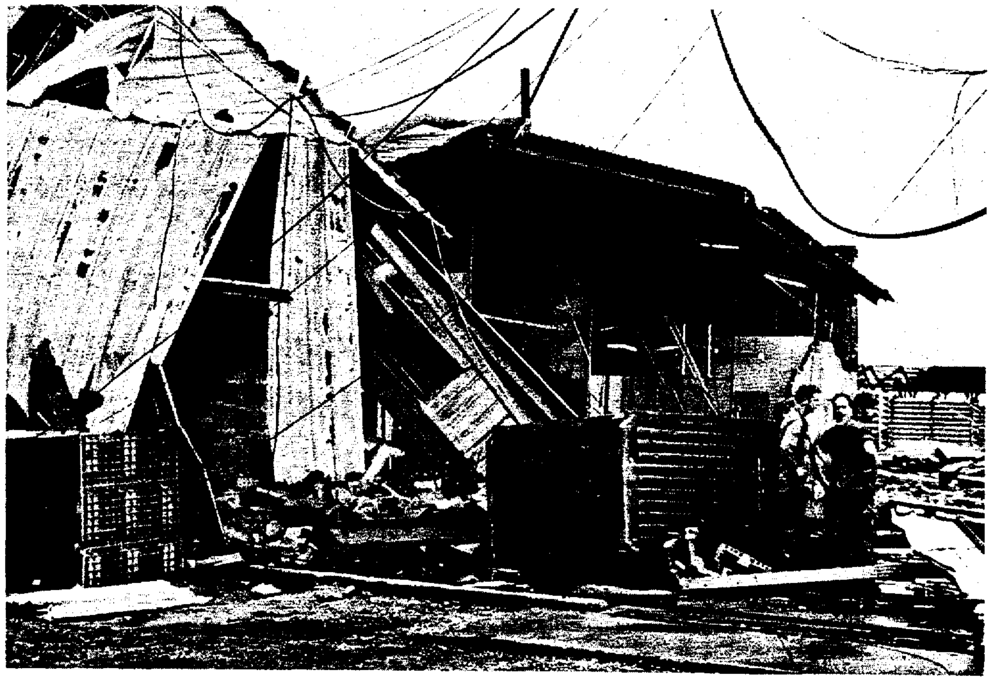


FIGURE 5-56. (TOP) DAMAGE SUSTAINED TO BARRACKS AT THE CHU LAI ARMY INSTALLATION, VIETNAM--COURTESY CORPS OF ENGINEERS U.S.A. (BOTTOM) SMALL CRAFT WASHED AGROUND NEAR CHU LAI ARMY INSTALLATION--COURTESY CORPS OF ENGINEERS U.S.A.

TYPHOON HESTER
EYE FIXES FOR CYCLONE NO. 36
18 OCT - 23 OCT 71

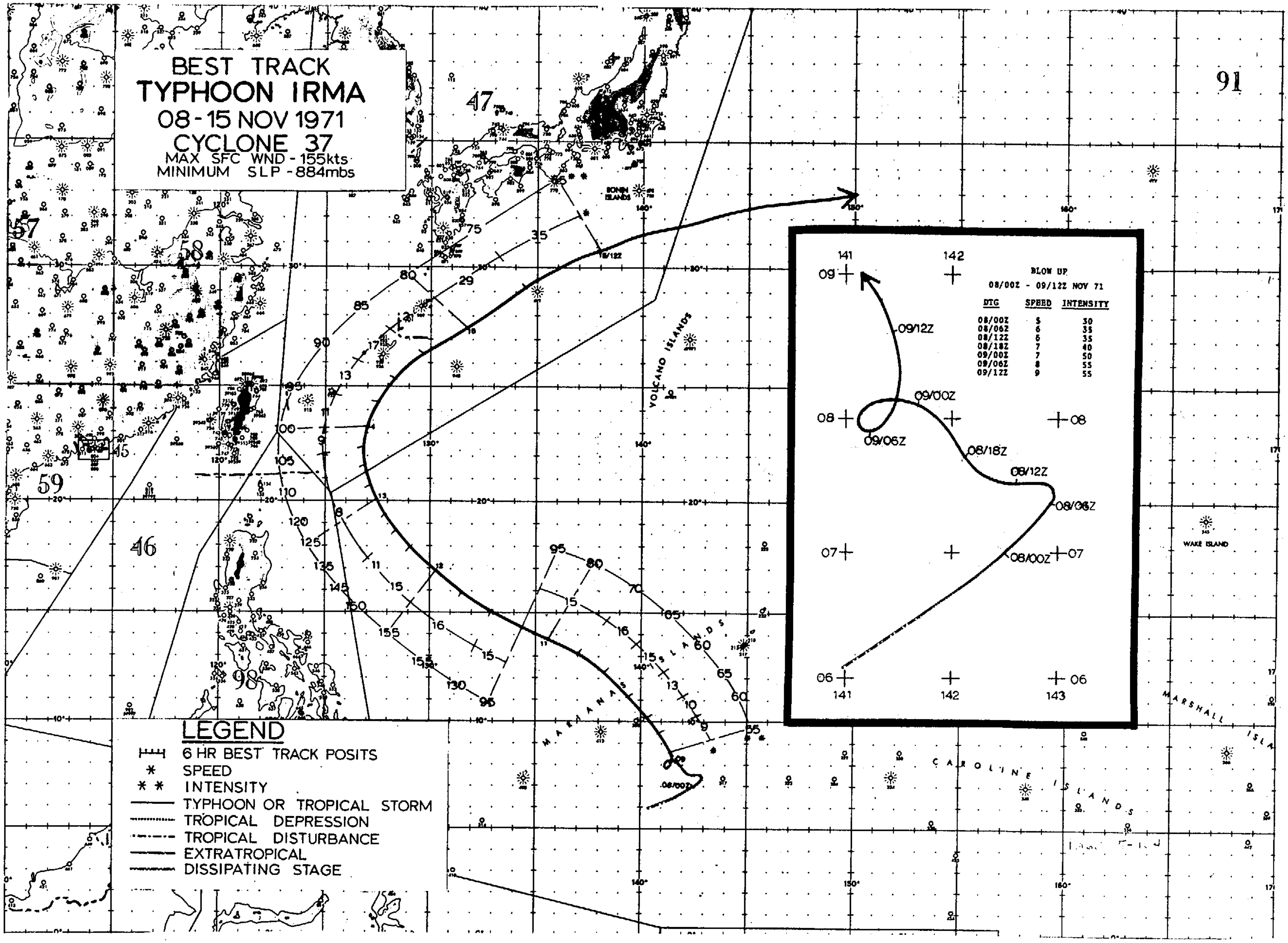
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
1	180340Z	9.5N 133.7E	54-P------	700MB	20	----	----	----	--/--	----	-----	--	--	700 MB WIND CNTR	
2	180457Z	8.5N 133.5E	SATELLIT---	STG B										FIRST BLTN	
3	190551Z	9.5N 130.3E	SATELLIT---	STG C.										STRONGER	
4	192335Z	9.3N 127.0E	54-P------	-----	----	40	----	----	--/--	----	-----	--	--	WIND CNTR	
5	200045Z	9.3N 126.9E	54-P- 1-14	700MB	35	40	990	2990	12/10	CIRC		30	--	POORLY DEFINED	
6	200400Z	9.6N 126.0E	54-P- 1-14	700MB	60	40	987	2947	12/10	CIRC		45	--	POORLY DEFINED	
7	200650Z	9.5N 125.5E	SATELLIT---	STG C.										LITTLE CHANGE	
8	201500Z	9.8N 121.2E	VQ-P- 5-10	700MB	----	----	990	3075	10/08	----	-----	--	--	V POORLY DEFINED	
9	202335Z	9.7N 121.2E	VQ-P------	-----	----	----	----	----	--/--	----	-----	--	--		
10	210110Z	9.8N 121.0E	54-P- 1- 5	700MB	45	75	987	2981	15/13	ELIP	NE-SW	30X20	--	CLSD WC-700 CNTR 15NM N	
11	210400Z	9.9N 120.5E	54-P- 2- 5	700MB	60	80	983	2954	17/11	ELIP	NE-SW	30X20	--	CLSD WC-700 CNTR 30NM N	
12	210557Z	10.0N 120.0E	SATELLIT---	STG X	DIA	3	CAT 2.5							STRONGER	
13	211000Z	10.8N 119.3E	54-P- 1- 9	500MB	60	----	984	2946	-4/-9	CIRC		30	5	WC OPEN NE-700MB CNTR 3NM W-500MB CNTR 15NM W	
14	211545Z	11.4N 117.1E	54-P- 2- 8	700MB	40	----	----	2883	15/13	CIRC		25	10	CLSD WC	
15	220656Z	13.5N 112.5E	SATELLIT---	STG X	DIA	3	CAT 3.5							STRONGER	
16	220710Z	13.0N 113.0E	54-P- 3- 5	700MB	67	65	----	2862	16/10	CIRC		50	--	POORLY DEFINED 700 CNTR 8NM WNW	
17	220944Z	13.0N 112.4E	54-P- 4- 5	700MB	61	65	----	2853	15/09	ELIP	N-S	20X12	--	WC OPEN SW-SFC CNTR 7NM E	
18	221234Z	13.9N 111.7E	54-P- 5- 5	700MB	81	----	----	2850	15/10	CIRC		20	7	V WEAK CLSD WC	
19	221550Z	14.1N 110.8E	54-P- 2- 8	700MB	95	----	972	2819	19/14	CIRC		25	10	WC OPEN E	
20	221900Z	14.3N 110.2E	54-P- 2- 8	700MB	80	----	967	2813	20/14	CIRC		25	10	WC OPEN SE	
21	221915Z	14.3N 110.2E	LND RDR---							----	-----	--	--	STN VVVS	
22	222045Z	14.4N 109.9E	LND RDR---							----	-----	--	--	STN VVVS	
23	222130Z	14.6N 109.7E	54-P- 3- 7	700MB	70	----	966	2816	20/14	CIRC		25	10	WC OPEN S-SE	
24	222245Z	14.8N 109.7E	LND RDR---							----	-----	--	--	STN VVVS	
25	222345Z	14.8N 109.6E	LND RDR---							----	-----	--	--	STN VVVS	
26	230015Z	14.0N 109.5E	LND RDR---							----	-----	--	--	STN VVVS	
27	230041Z	14.9N 109.5E	VQ-P- 3---	-----	----	100	973	----	26/21	CIRC		28	--	WC OPEN S SEMIC	
28	230115Z	14.8N 109.3E	LND RDR---							----	-----	--	--	STN VVVS	
29	230145Z	14.9N 109.2E	LND RDR---							----	-----	--	--	STN VVVS	
30	230215Z	15.0N 109.0E	LND RDR---							----	-----	--	--	STN VVVS	
31	230753Z	16.0N 108.0E	SATELLIT---	STG X	DIA	4	CAT 2.0							NO EYE VISIBLE	

TYPHOON HESTER

1200Z 19 OCT TO 1800Z 23 OCT

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
191200Z	9.6N 129.8E	35	9.3N 129.7E	30	19	-5	9.3N 126.5E	55	160	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--
191800Z	9.5N 128.5E	40	9.3N 128.9E	30	26	-10	9.3N 125.7E	50	195	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--
200000Z	9.5N 127.0E	50	9.3N 126.9E	40	13	-10	9.3N 122.9E	45	103	-15	9.3N 119.2E	60	316	-15	9.7N 116.1E	70	512	-20
200600Z	9.5N 125.4E	50	9.5N 125.7E	40	18	-10	9.3N 121.6E	55	114	-15	9.4N 117.6E	65	343	-15	--.- ---.-	--	--	--
201200Z	9.6N 123.8E	45	9.4N 124.7E	45	54	0	9.3N 120.7E	55	179	-15	9.7N 116.7E	65	386	-20	10.6N 113.2E	75	479	25
201800Z	9.6N 122.4E	50	9.9N 122.5E	40	19	-10	10.7N 116.9E	65	64	-10	11.9N 111.8E	75	165	-15	--.- ---.-	--	--	--
210000Z	9.7N 121.2E	60	9.8N 121.0E	70	13	10	10.3N 116.2E	90	152	15	11.2N 111.8E	95	273	5	--.- ---.-	--	--	--
210600Z	10.2N 119.9E	70	9.9N 120.1E	80	21	10	10.7N 115.4E	95	197	15	11.9N 111.0E	95	274	20	--.- ---.-	--	--	--
211200Z	11.0N 118.2E	70	10.9N 118.6E	85	24	15	11.7N 114.0E	95	188	10	13.7N 110.1E	85	220	35	--.- ---.-	--	--	--
211800Z	11.7N 116.5E	75	11.7N 116.5E	90	0	15	13.7N 109.8E	85	50	-5	15.4N 103.9E	25	145	-10	--.- ---.-	--	--	--
220000Z	12.5N 114.9E	75	12.2N 115.0E	90	19	15	14.1N 109.7E	85	61	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
220600Z	13.2N 113.2E	80	13.2N 113.3E	85	6	5	15.2N 107.7E	40	37	-35	--.- ---.-	--	--	--	--.- ---.-	--	--	--
221200Z	13.8N 111.6E	85	13.8N 111.9E	80	17	-5	15.5N 106.5E	30	54	-20	--.- ---.-	--	--	--	--.- ---.-	--	--	--
221800Z	14.3N 110.4E	90	14.3N 110.3E	80	6	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
230000Z	15.0N 109.2E	90	14.7N 109.2E	80	18	-10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
230600Z	15.6N 108.2E	75	15.5N 108.2E	75	6	0	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
231200Z	16.1N 107.2E	50	16.1N 107.3E	60	6	10	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
231800Z	16.4N 106.2E	35	16.6N 106.5E	40	21	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	17NM	120NM	265NM	495NM	17NM	120NM	265NM	495NM
AVERAGE RIGHT ANGLE ERROR	10NM	41NM	103NM	131NM	10NM	41NM	103NM	131NM
AVERAGE MAGNITUDE OF WIND ERROR	9KTS	13KTS	17KTS	23KTS	9KTS	13KTS	17KTS	23KTS
AVERAGE BIAS OF WIND ERROR	1KTS	-5KTS	-2KTS	3KTS	1KTS	-5KTS	-2KTS	3KTS
NUMBER OF FORECASTS	18	13	8	2	18	13	8	2


BEST TRACK
TYPHOON IRMA
08-15 NOV 1971
CYCLONE 37
MAX SFC WND - 155kts
MINIMUM SLP - 884mbs
VOLCANO ISLANDS
BONIN ISLANDS
MARIANAS ISLANDS
CAROLINE ISLANDS
MARSHALL ISLANDS
WAKE ISLAND
BLOW UP
08/00Z - 09/12Z NOV 71
DTG SPEED INTENSITY
08/00Z 5 30
08/06Z 6 35
08/12Z 6 35
08/18Z 7 40
09/00Z 7 50
09/06Z 8 55
09/12Z 9 55
LEGEND
6 HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE

IRMA

The last and most intense typhoon of the year was first noted on synoptic charts as a quasi-stationary circulation in the western Carolines on the 2nd of November. By the 6th, a strong band of westerlies developed south of 5N. The long fetch of these winds resulted in increased seas which affected the atolls in the area. Early on the 8th, satellite data showed that the cloudiness associated with the system was showing increasing organization, and tropical storm Irma was born.

Later in the afternoon, Woleai Atoll reported 30 kt with gusts to 50 kt as the storm center was located by reconnaissance aircraft 50 n mi west of the station (Figure 5-57). Reports from Eauripik Atoll indicated that high seas had inundated 200 ft inland and several houses were washed away.

Irma's track was erratic for the next 24 hours until she began a northwestward heading, passing 30 n mi west of Ulithi the morning of the 10th. Reports from the atoll indicated 30 kt, gusts to 60 kt and a minimum sea level pressure of 996.3 mb. Of the Yap district only Fais and Ulithi atolls had appreciable damage and this was limited to crops.

Reaching typhoon force the evening of the 10th, Irma described a smooth northwesterly track, attaining super-typhoon status late on the 11th. Reaching peak winds in excess of 150 kt during the 12th and remaining in the 130-kt-plus classification for a 36-hour period, Irma began to recurve around the subtropical ridge at 127E. Paralleling the Ryukyu Island chain and accelerating in forward speed as she came under the influence of the westerlies, Irma transformed to extratropical characteristics as she sped south of Honshu on the 15th at 35 kt. During the passage of the eye 65 n mi east of Okinawa, highest winds experienced on the island were at Naha, which recorded 48 kt gusting to 80 kt, while Kadena AB reported 45 kt with gusts to 64 kt.

At sea, the 2,474-ton Panamanian HUALIEN was run aground at Peng Chia Hsu Island northeast of Taipei presumably by heavy swells. The 13,616-ton Liberian ore carrier BANALUNA bound from Leyte Island, Philippines to Tobata, Japan was reported missing and feared to have went down during Irma.

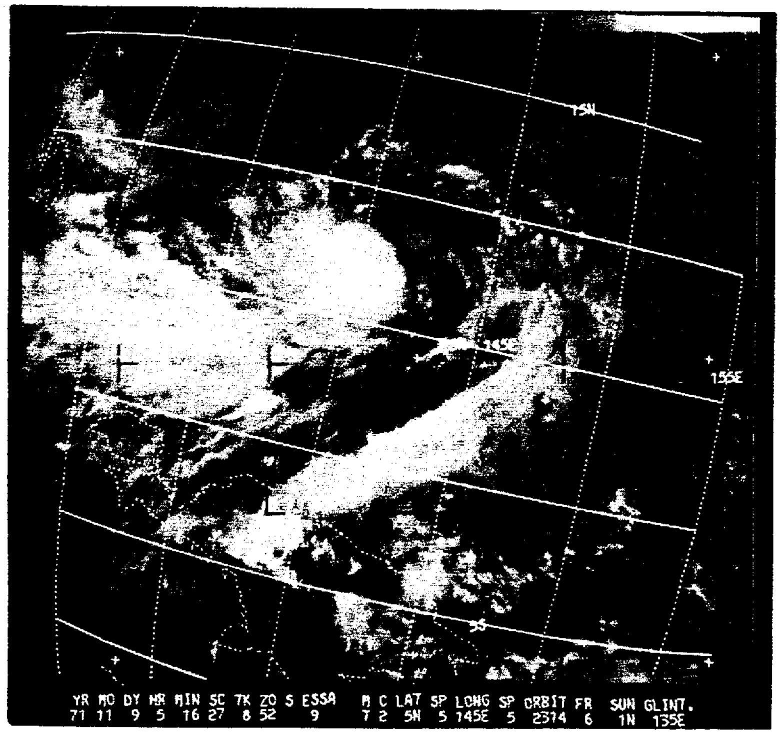


FIGURE 5-57. ESSA-9 PHOTO OF IRMA AS A TROPICAL STORM LOCATED WEST OF WOLEAI ATOLL ON 9 NOVEMBER.

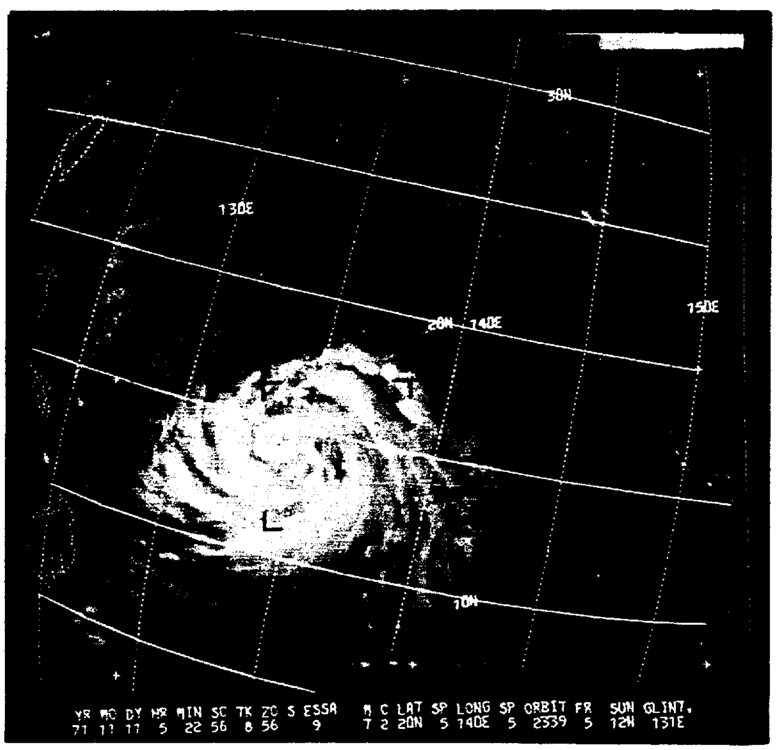


FIGURE 5-58. TYPHOON IRMA DURING HER RAPID DEEPENING STAGE IN THE PHILIPPINE SEA ON THE AFTERNOON OF 11 NOVEMBER.

The most significant aspect to typhoon Irma was the explosive deepening rate of 4 mb per hour which took place during a 24-hour period spanning the 10th and 11th of November (Figures 5-58 and 5-59). The deepening culminated in a dropsonde reading of 884 mb, which ranked the storm's central pressure among the lowest on record.*

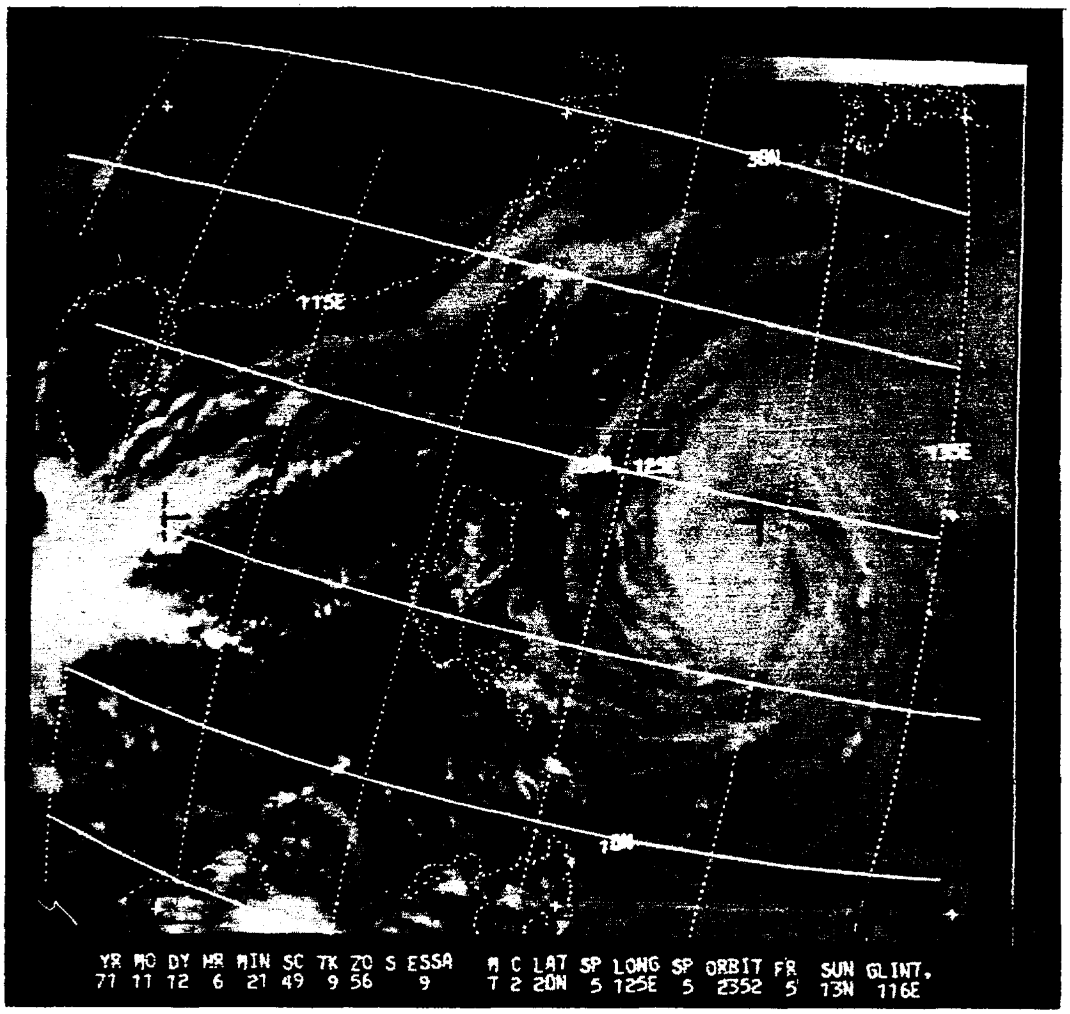


FIGURE 5-59. SUPER TYPHOON IRMA AS PHOTOGRAPHED BY ESSA-9 EAST OF LUZON ON 12 NOVEMBER.

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*Typhoon's Joan (Aug 59) - 884 mb, Nina (Aug 53) - 883 mb, Ida (Sep 58) - 877 mb (see Jordan, 1961).

TYPHOON IRMA
EYE FIXES FOR CYCLONE NO. 37
08 NOV - 15 NOV 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT. OF RADAR
1	080305Z	7.2N 142.8E	54-P- 5-15	700MB	40	35	992	3008	12/11	----	-----	--	--	NO RDR PRES-700 CNTR 20NM E	
2	081000Z	7.4N 143.2E	54-P- 5-10	700MB	30	----	1003	3079	11/09	----	-----	--	--	NO RDR PRES	
3	081600Z	7.2N 142.4E	54-P- 5-15	700MB	30	----	1003	3082	10/09	----	-----	--	--	NO RDR PRES	
4	082204Z	8.1N 141.8E	54-P-15---	700MB	30	35	995	3054	13/12	----	-----	--	--	SFC CNTR ILL DEF	
5	090400Z	8.0N 141.1E	54-P- 8- 2	700MB	48	90	991	3030	13/12	----	-----	--	--	WC FRMG RAPIDLY	
6	090517Z	7.5N 141.0E	SATELIT---	STG X	DIA	5	CAT 2.0							FIRST BLTN	
7	090955Z	8.3N 141.4E	54-P- 3- 3	700MB	30	----	981	2941	15/11	ELIP	E-W	15X10	5	WEAK CLSD WC	
8	091243Z	8.7N 141.4E	54-P- 2-10	700MB	35	----	983	2963	15/10	ELIP	E-W	15X10	--	WC OPEN NW-MDT FB	
9	091526Z	9.3N 141.0E	54-P- 3- 9	700MB	45	----	983	2954	14/10	ELIP	E-W	20X10	5	CLSD WC	
10	092147Z	9.7N 140.5E	54-P- 5- 5	700MB	40	60	984	2947	12/11	CIRC		20	10	FAIR RDR PRES	
11	100019Z	10.2N 140.2E	54-P- 8- 7	700MB	45	85	987	2963	12/10	CIRC		10	10	CLSD WC	
12	100311Z	10.7N 139.7E	54-P- 5- 5	700MB	45	50	985	2947	13/09	CIRC		20	10	CLSD WC	
13	100619Z	11.0N 138.5E	SATELIT---	STG C											
14	101000Z	11.9N 138.8E	54-P- 2- 8	700MB	50	----	983	2951	15/13	----	-----	--	5	WC SE ONLY	
15	101527Z	12.8N 137.4E	54-P- 2- 3	700MB	60	----	981	2932	15/13	----	-----	--	--	POORLY DEFINED	
16	102205Z	13.6N 136.1E	54-P- 2---	700MB	60	70	969	2840	18/16	CIRC		15	10	700MB FIX	
17	110340Z	14.2N 134.8E	54-P- 3---	700MB	80	70	961	2752	18/13	CIRC		15	8	700MB FIX	
18	110523Z	14.2N 134.0E	SATELIT---	STG X	DIA	4	CAT 3.0							STRONGER	
19	111155Z	14.9N 132.8E	54-P- 2- 1	700MB	80	100	910	2295	21/11	CIRC		6	5	CLSD WC	
20	111555Z	15.6N 132.3E	54-P- 3- 1	700MB	80	120	884	2060	24/11	CONC	-	40X 7	5	SFC WIND OBSERVED DUE TO INT LTNG	
21	112200Z	16.6N 130.7E	54-P- 6- 2	700MB	70	130	884	2040	26/11	CIRC		5	--	CLSD WC	
22	120300Z	17.5N 129.6E	54-P- 3- 2	700MB	80	130	893	2120	20/12	CIRC		5	2	CLSD WC	
23	120622Z	17.7N 129.2E	SATELIT---	STG X	DIA	4	CAT 4.0								
24	120934Z	18.4N 128.7E	54-P- 2- 2	700MB	107	----	----	2131	26/11	CIRC		10	4	CLSD WC	
25	121505Z	19.0N 128.0E	54-P- 2- 2	700MB	127	----	----	2158	21/18	CIRC		12	5	CLSD WC	
26	122220Z	19.8N 127.7E	54-P- 2- 4	700MB	115	130	913	2313	16/13	CIRC		10	5	CLSD WC	
27	130110Z	20.1N 127.4E	54-P- 2- 5	700MB	110	120	926	2423	17/11	CIRC		10	6	WC OPEN E	
28	130310Z	20.4N 127.3E	54-P- 2- 5	700MB	110	130	925	2442	17/15	CIRC		10	--	WC OPEN E-S	
29	130525Z	20.5N 127.1E	SATELIT---	STG X	DIA	3	CAT 4.0							SML EYE VISIBLE	
30	130700Z	21.0N 127.1E	54-P- 2---	700MB	110	90	929	2478	16/13	CIRC		15	8	WC OPEN SW	
31	131000Z	21.4N 127.0E	54-P- 2---	700MB	80	----	936	2518	18/15	CIRC		6	10		
32	131200Z	21.7N 127.0E	54-P- 7---	700MB	95	----	938	2557	18/14	CIRC		5	--	NO WC	
33	131532Z	22.0N 126.8E	54-P- 2- 3	700MB	73	----	----	2597	19/18	----	-----	--	--	NO RDR PRES	
34	131844Z	22.5N 126.8E	54-P- 3- 4	700MB	85	----	----	2612	18/17	CIRC		12	2	WK RDR PRES	
35	131845Z	22.7N 127.0E	LND RDR---							----	-----	--	--	STN MIYAKO JIMA	
36	132000Z	22.6N 126.8E	LND RDR---							----	-----	--	--	STN 47927	
37	132143Z	23.0N 127.0E	54-P- 2- 3	700MB	81	----	----	2643	16/16	CIRC		12	2	CLSD WC-WEAK	
38	140100Z	23.4N 127.1E	LND RDR---							----	-----	--	--	STN 47927	
39	140200Z	23.6N 127.2E	LND RDR---							----	-----	--	--	STN 47927	
40	140350Z	23.9N 127.3E	54-P------	-----	----	----	----	----	--/--	----	-----	--	--		
41	140400Z	23.9N 127.3E	LND RDR---							----	-----	--	--	STN 47927	
42	140400Z	23.7N 127.3E	LND RDR---							----	-----	--	--	STN 47936	
43	140400Z	23.8N 127.3E	54-P- 2- 5	700MB	85	100	954	2673	16/15	CIRC		40	--	POORLY DEFINED	
44	140500Z	23.9N 127.5E	LND RDR---							----	-----	--	--	STN 47936	
45	140500Z	24.0N 127.4E	LND RDR---							----	-----	--	--	STN 47927	
46	140600Z	24.2N 127.6E	LND RDR---							----	-----	--	--	STN 47936	
47	140600Z	24.2N 127.5E	LND RDR---							----	-----	--	--	STN 47927	
48	140624Z	24.3N 128.0E	SATELIT---	STG X	DIA	4	CAT 3.0							SML EYE VISIBLE	

TYPHOON IRMA
EYE FIXES FOR CYCLONE NO. 37
08 NOV - 15 NOV 71

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	EYE FORM	ORIENTATION	EYE DIA	THKN WALL CLD	REMARKS	POSIT OF RADAR
49	140700Z	24.4N 127.6E	LND RDR---							----	-----	--	--	STN 47936	
50	140700Z	24.3N 127.7E	LND RDR---							----	-----	--	--	STN 47927	
51	140800Z	24.9N 127.7E	LND RDR---							----	-----	--	--	STN YOZE DAKE	
52	140900Z	24.9N 127.9E	LND RDR---							----	-----	--	--	STN 47927	
53	140900Z	24.9N 128.1E	LND RDR---							----	-----	--	--	STN 47936	
54	140935Z	25.0N 128.0E	54-P- 2-10	700MB	85	130	960	2694	15/19	----	-----	--	--	NO WC	
55	141000Z	25.0N 128.4E	LND RDR---							----	-----	--	--	STN 47936	
56	141000Z	25.3N 128.0E	LND RDR---							----	-----	--	--	STN 47927	
57	141100Z	25.2N 128.6E	LND RDR---							----	-----	--	--	STN 47936	
58	141200Z	25.3N 128.6E	LND RDR---							----	-----	--	--	STN 47936	
59	141725Z	26.2N 129.5E	54-P- 7---	700MB	70	----	960	2731	15/12	CIRC		10	--	POORLY DEFINED	
60	141800Z	26.4N 129.8E	LND RDR---							----	-----	--	--	STN 47936	
61	142000Z	26.8N 130.5E	VO--------	-----	----	----	----	----	--/--	----	-----	--	--	STN 47909	
62	142100Z	26.9N 131.0E	VO--------	-----	----	----	----	----	--/--	----	-----	--	--	STN 47909	
63	142145Z	27.0N 130.9E	54-P- 5---	700MB	85	60	966	2783	13/15	----	-----	--	--	POOR RDR PRES	
64	142200Z	27.1N 131.2E	VO--------	-----	----	----	----	----	--/--	----	-----	--	--	STN 47909	
65	142300Z	27.7N 131.8E	VO--------	-----	----	----	----	----	--/--	----	-----	--	--	STN 47909	
66	150000Z	27.7N 132.3E	VO--------	-----	----	----	----	----	--/--	----	-----	--	--	STN 47909	
67	150405Z	28.6N 133.7E	54-P- 4- 5	700MB	100	95	965	2758	16/14	----	-----	--	--	NO RDR PRES	
68	150531Z	28.5N 134.8E	SATELLI---	STG X	DIA	4 CAT	2.5								
69	150907Z	30.0N 136.2E	54-P- 5- 5	700MB	70	----	967	2774	13/13	----	-----	--	--	NO RDR PRES	

TYPHOON IRMA

0000Z 08 NOV TO 1200Z 15 NOV

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
080000Z	6.9N 142.6E	30	6.9N 142.7E	30	6	0	8.1N 142.6E	45	59	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--
080600Z	7.3N 143.0E	35	7.4N 142.8E	35	13	0	9.2N 142.1E	55	94	0	11.1N 138.8E	70	36	10	--.- ---.-	--	--	--
081200Z	7.4N 142.6E	35	7.6N 143.1E	40	32	5	9.7N 142.5E	55	92	0	11.3N 139.0E	70	72	5	12.4N 134.2E	85	178	-45
081800Z	7.8N 142.1E	40	7.4N 142.6E	40	38	0	8.2N 142.6E	55	123	-5	10.3N 140.9E	65	283	-5	--.- ---.-	--	--	--
090000Z	8.2N 141.6E	50	8.2N 142.3E	40	41	-10	10.0N 141.0E	55	42	-10	11.7N 137.3E	70	160	-10	12.6N 132.6E	85	289	-70
090600Z	7.9N 141.2E	55	8.2N 140.9E	70	25	15	8.3N 137.4E	90	209	30	9.7N 133.2E	120	288	25	--.- ---.-	--	--	--
091200Z	8.6N 141.4E	55	8.2N 140.9E	70	38	15	8.2N 138.3E	90	245	25	9.2N 134.4E	115	363	-15	10.8N 130.7E	125	496	-20
091800Z	9.4N 140.9E	60	9.4N 140.7E	75	12	15	10.2N 137.8E	95	179	25	11.2N 133.9E	120	316	-35	--.- ---.-	--	--	--
100000Z	10.1N 140.3E	65	9.9N 140.3E	75	12	10	10.7N 137.0E	95	202	15	11.5N 133.0E	120	358	-35	13.2N 129.4E	125	426	0
100600Z	11.2N 139.4E	60	11.1N 139.4E	75	6	15	12.5N 135.6E	95	136	0	13.4N 131.6E	120	307	-30	--.- ---.-	--	--	--
101200Z	12.3N 138.3E	65	12.3N 138.3E	75	0	10	15.0N 134.0E	85	64	-45	16.8N 129.8E	90	144	-55	19.3N 127.3E	90	139	-20
101800Z	13.1N 137.0E	70	13.3N 136.9E	75	13	5	15.9N 131.7E	85	8	-70	18.0N 128.3E	85	87	-50	--.- ---.-	--	--	--
110000Z	13.8N 135.6E	80	13.8N 135.6E	80	0	0	16.0N 130.8E	100	61	-55	18.1N 127.2E	110	121	-15	21.4N 126.0E	95	121	-5
110600Z	14.4N 134.3E	95	14.5N 134.4E	90	8	-5	16.6N 129.5E	110	80	-40	19.1N 126.3E	115	111	-5	--.- ---.-	--	--	--
111200Z	15.1N 132.9E	130	14.9N 132.8E	130	13	0	17.4N 127.9E	125	88	-20	20.4N 126.0E	95	87	-15	26.1N 130.2E	65	110	-25
111800Z	16.0N 131.6E	155	15.7N 131.8E	155	21	0	18.6N 127.7E	125	49	-10	22.3N 127.3E	100	28	-5	--.- ---.-	--	--	--
120000Z	16.9N 130.3E	155	16.9N 130.2E	155	6	0	20.8N 126.7E	110	61	-15	25.7N 129.7E	85	209	-15	--.- ---.-	--	--	--
120600Z	17.9N 129.2E	150	18.0N 129.0E	140	13	-10	22.2N 127.2E	100	84	-20	27.3N 132.0E	55	305	-40	--.- ---.-	--	--	--
121200Z	18.8N 128.4E	145	18.7N 128.4E	135	6	-10	22.4N 127.0E	100	48	-10	27.3N 131.0E	60	184	-30	--.- ---.-	--	--	--
121800Z	19.4N 127.9E	135	19.4N 127.8E	135	6	0	23.0N 127.1E	100	45	-5	27.9N 132.2E	60	156	-25	--.- ---.-	--	--	--
130000Z	20.1N 127.5E	125	20.0N 127.5E	130	6	5	24.3N 127.8E	100	79	0	29.6N 135.5E	40	228	-40	--.- ---.-	--	--	--
130600Z	20.8N 127.1E	120	21.0N 127.2E	125	13	5	26.1N 129.4E	85	153	-10	30.9N 138.5E	40	238	-35	--.- ---.-	--	--	--
131200Z	21.6N 126.9E	110	21.7N 127.1E	110	13	0	27.3N 130.4E	75	160	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
131800Z	22.3N 126.8E	105	22.4N 126.7E	100	8	-5	27.7N 130.3E	70	82	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
140000Z	23.2N 127.0E	100	23.4N 127.2E	90	16	-10	28.8N 132.9E	50	92	-30	--.- ---.-	--	--	--	--.- ---.-	--	--	--
140600Z	24.2N 127.5E	95	24.1N 127.5E	95	6	0	29.2N 133.7E	50	37	-25	--.- ---.-	--	--	--	--.- ---.-	--	--	--
141200Z	25.4N 128.3E	90	25.6N 128.5E	95	16	5	30.7N 136.7E	50	67	-15	--.- ---.-	--	--	--	--.- ---.-	--	--	--
141800Z	26.4N 129.8E	85	26.3N 129.6E	90	12	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
150000Z	27.6N 131.8E	80	27.5N 131.8E	75	6	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
150600Z	29.1N 134.4E	75	29.0N 134.7E	80	17	5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--
151200Z	30.7N 138.0E	65	30.9N 137.6E	60	24	-5	--.- ---.-	--	--	--	--.- ---.-	--	--	--	--.- ---.-	--	--	--

	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	15NM	98NM	194NM	251NM	14NM	98NM	194NM	251NM
AVERAGE RIGHT ANGLE ERROR	9NM	50NM	78NM	123NM	9NM	50NM	78NM	123NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	19KTS	24KTS	26KTS	6KTS	19KTS	24KTS	26KTS
AVERAGE BIAS OF WIND ERROR	2KTS	-12KTS	-20KTS	-26KTS	2KTS	-12KTS	-20KTS	-26KTS
NUMBER OF FORECASTS	30	27	21	7	31	27	21	7

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Fett, R. F., "Some Unusual Aspects Concerning the Development and Structure of Typhoon Billie," Monthly Weather Review, Vol. 96, No. 9, September 1968, pp 637-648.

Jordan, C. L., "Marked Changes in the Characteristics of the Eye of Intense Typhoons Between the Deepening and Filling Stages," National Hurricane Research Project Report, No. 44, U.S. Weather Bureau, Washington, D. C., May 1961, p 7.

Takahashi, K., "Distribution of Pressure and Wind in a Typhoon," Journal of the Meteorological Society of Japan, 2nd Series, Vol. 17, No. 11, November 1939, pp 417-421.

DEFINITIONS OF TERMS AND ABBREVIATIONS IN CHAPTER 5

1. Units

Distance - nautical miles
Speed - knots
Geopotential height - meters
Flight level - meters or standard pressure level
Pressure - millibars
Temperature - degrees Celsius

2. With reference to summaries of fix data, the following terms and abbreviations apply:

a. UNIT - Reconnaissance unit that made the fix
54WRS - 54th Weather Reconnaissance Squadron
VQ-1 - Fleet Air Reconnaissance Squadron One
LND RDR - Land radar site
SHP RDR - Ship radar
SATELIT - Satellite bulletin from National Environmental Satellite Service

b. METHOD

P - Penetration
R - Airborne radar

c. ACCY - Estimated navigational (1st number) and meteorological (2nd) accuracy

d. OBS SFC WND - Maximum observed surface wind

e. FLT LVL WND - Maximum observed wind at flight level

f. FLT LVL TI/TO - Temperature inside/outside the eye or center at flight level

g. EYE FORM - Shape of eye

CIRC - Circular
ELIP - Elliptical
CONC - Concentric

h. ORIENTATION - Orientation of major axis of elliptical eye

ABBREVIATIONS

ABT	About
ACFT	Aircraft
ANAL	Analysis
BCMG	Becoming
BGNG	Beginning
BLTN	Bulletin
BRKS	Breaks
BRLY	Barely
BRT	Bright
BSD	Based
CHG	Change
CI	Cirrus
CIRC	Circulation
CLD	Cloud
CLSD	Closed
CONC	Concentric
CONT	Continuous
CONV	Convective
CS	Cirrostratus
DEF	Defined
DEVEL	Developed
DIA	Diameter
DISORG	Disorganized
DSPTG	Dissipating
ELSW	Elsewhere
EST	Estimated
EXC	Excellent
FBS	Feeder Bands
FL	Flight Level
FNTL	Frontal
FRMG	Forming
FWC	Fleet Weather Central
GRAD	Gradient
HK	Hong Kong
HR	Hour
HVY	Heavy
IRREG	Irregular
K	Thousand
KT	Knots
LGT	Light
LND	Land
LRG	Large
LTL	Little
LTNG	Lightning
MDT	Moderate
MSLP	Minimum Sea Level Pressure
NM	Nautical Miles
NEG	Negative
ORGANIZ	Organized
OVC	Overcast
OVR	Over
PIREP	Pilot Report
POSIT	Position
PRES	Presentation
PRESS	Pressure
PRELIM	Preliminary
PSBL	Possible
PSG	Passage
QUAD	Quadrant
RDR	Radar
REP PHIL	Republic of the Philippines
RETRN	Return
RMR	Remark
SAT	Satellite
SC	Stratocumulus
SEMIC	Semicircle
SEV	Severe
SFC	Surface
SML	Small
SST	Sea Surface Temperature
STG	Strong
STN	Station
STRM	Storm
TEMPS	Temperatures
TURB	Turbulence
UKN	Unknown
V	Very
VIS	Visable
VSBL	Visable
WC	Wall Cloud
WK	Weak
WKR	Weaker
WND	Wind
YSTY	Yesterday

ANNEX

A

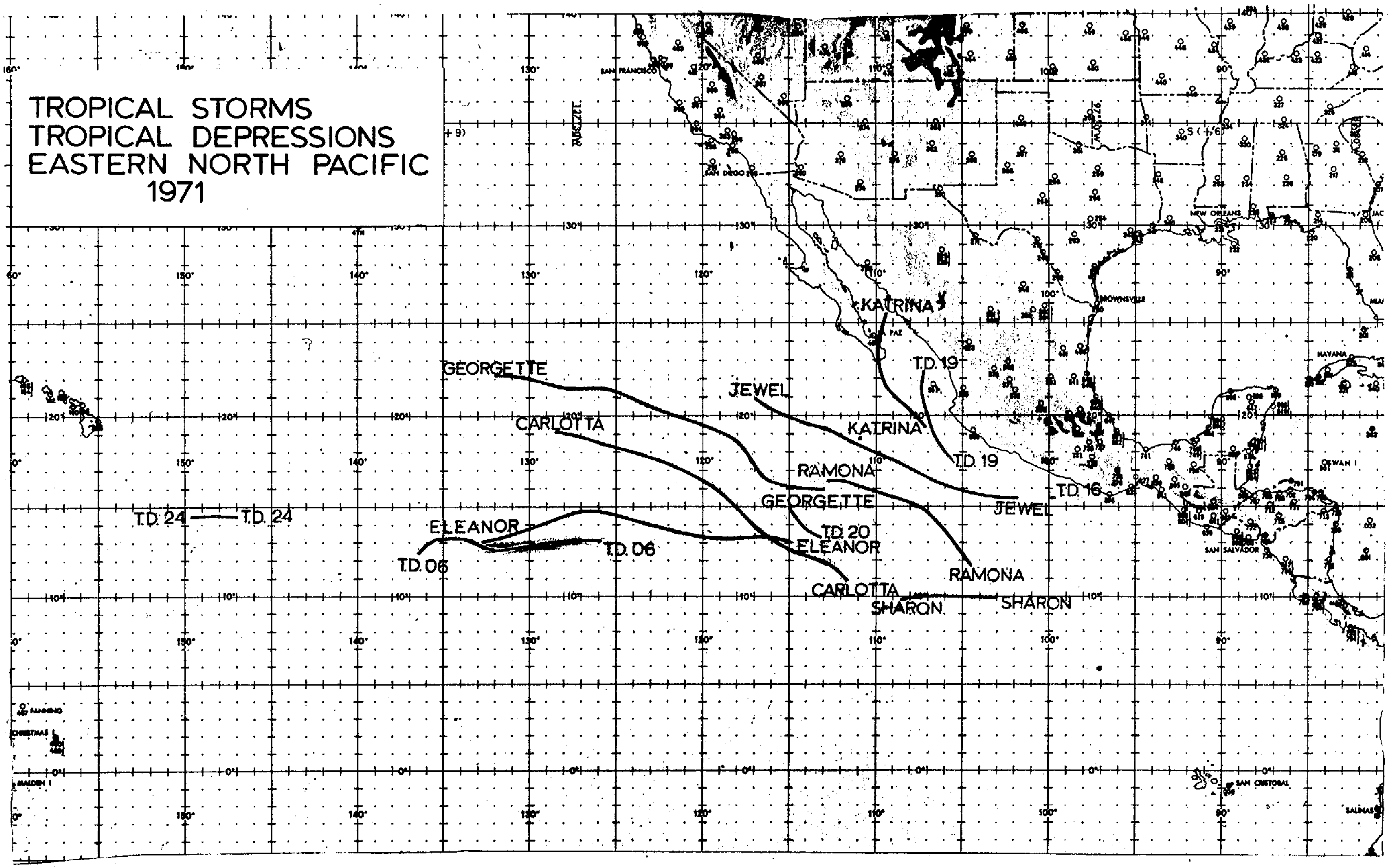
SUMMARY OF TROPICAL CYCLONES

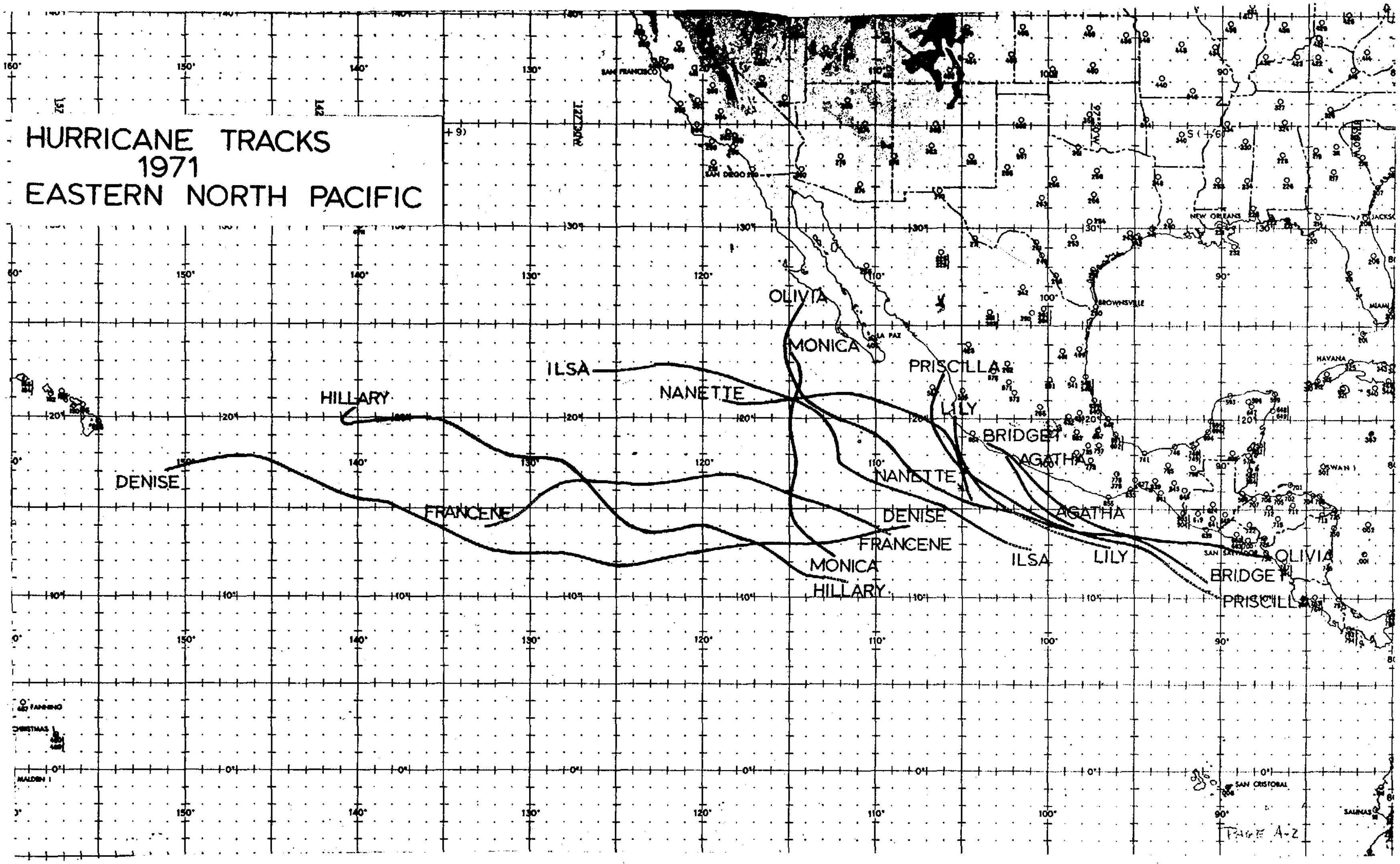
IN THE

EASTERN AND CENTRAL NORTH PACIFIC OCEAN

FOR

1971


TROPICAL STORMS
TROPICAL DEPRESSIONS
EASTERN NORTH PACIFIC
1971
KATRINA
T.D. 19
GEORGETTE
JEWEL
CARLOTTA
KATRINA
T.D. 19
RAMONA
T.D. 16
GEORGETTE
JEWEL
T.D. 24
T.D. 24
ELEANOR
T.D. 20
T.D. 06
ELEANOR
T.D. 06
RAMONA
CARLOTTA
SHARON
SHARON
SAN FRANCISCO
SAN DIEGO
NEW ORLEANS
BROWNSVILLE
HAVANA
SAN SALVADOR
FANNING
CHRISTMAS
MALDEN I
SAN CRISTOBAL


HURRICANE TRACKS
1971
EASTERN NORTH PACIFIC
OLIVIA
MONICA
ILSA
PRISCILLA
HILLARY
NANETTE
LILY
BRIDGET
AGATHA
DENISE
NANETTE
FRANCENE
AGATHA
DENISE
FRANCENE
ILSA
LILY
OLIVIA
MONICA
BRIDGET
HILLARY
PRISCILLA
SAN FRANCISCO
SAN DIEGO
LA PAZ
BROWNSVILLE
NEW ORLEANS
HAVANA
SAN CRISTOBAL
Page A-2

EASTERN NORTH PACIFIC

During the 1971 EASTPAC Tropical Cyclone season, Fleet Weather Central, Alameda issued a total of 410 tropical warnings on eleven hurricanes, a new record for the eastern North Pacific, eight tropical storms, and three tropical depressions. As occurred in 1970, two tropical disturbances moved out of Alameda's area of responsibility.

The 1971 season resulted in a "first" in the case of "OLIVIA", which jumped from the Atlantic to the Pacific. This was a phenomena which has not been recorded as far back as can be established by existing records. With a total of 22 tropical cyclones reported, 1971 becomes the second highest year for activity, with 1968 still in first place with 25. It is felt that continued improvement in meteorological satellite interpretation, and an increased awareness on the part of cooperating marine observers enhanced the information available for reporting, tracking, and forecasting tropical storms in 1971.

The following five year summary covering tropical cyclones originating in Fleet Weather Central, Alameda's area of responsibility is presented for comparison.

	1967	1968	1969	1970	1971
TOTAL NUMBER OF WARNINGS	474	531	219	350	410
CALENDAR DAYS OF WARNINGS	119	126	67	98	89
TROPICAL DEPRESSIONS	2	6	5	3	3
TROPICAL STORMS	12	13	6	15	8
HURRICANES	6	6	4	3	11
TOTAL	20	25	15	21	22

FORECASTING TOOLS: Tools used for forecasting the progress of tropical cyclones included twice daily readouts from Fleet Numerical Weather Central Monterey's "HATRACK" steering program; twice daily readouts from Fleet Weather Central Pearl Harbor's "TYRACK" steering program, extrapolation and subjective reasoning. Some of the greatest aids to forecasting consisted of the daily APT pictures received via FOFAX and the special satellite bulletins from FWF SUITLAND, MD.

Eastern Pacific hurricane flights were made by 55th Weather Recon Squadron, 9th Weather Wing, and were invaluable for pin point location, intensification, and verification of tropical cyclones and hurricanes. A total of 76 flights were made.

Co-operating naval vessels, as well as some excellent radar fixes by the Royal Navy from HMS BLAKE greatly aided in precise location of storms this season. Transiting merchant vessels again were excellent contributors to accurate storm location through the synoptic observation program.

DAMAGE: No damage reports from 1971 tropical storms or hurricanes going ashore in Mexico are available to this office, however, it is suspected that some crop damage and local flooding occurred with the onshore movement of five hurricanes this season.

TROPICAL CYCLONES 1971 SEASON WARNINGS
ORIGINATED BY FLEET WEATHER CENTRAL, ALAMEDA, CALIFORNIA

	CYCLONE	PERIOD
01	HURRICANE AGATHA	22 MAY - 24 MAY 1971
02	HURRICANE BRIDGET	14 JUN - 17 JUN 1971
03	TROPICAL STORM CARLOTTA	02 JUL - 07 JUL 1971
04	HURRICANE DENISE	04 JUL - 10 JUL 1971
05	TROPICAL STORM ELEANOR	08 JUL - 11 JUL 1971
06	TROPICAL DEPRESSION SIX	14 JUL - 17 JUL 1971
07	HURRICANE FRANCENE	18 JUL - 25 JUL 1971
08	TROPICAL STORM GEORGETTE	23 JUL - 27 JUL 1971
09	HURRICANE HILARY	26 JUL - 06 AUG 1971
10	HURRICANE ILSA	31 JUL - 08 AUG 1971
11	TROPICAL STORM JEWEL	06 AUG - 11 AUG 1971
12	TROPICAL STORM KATRINA	11 AUG - 12 AUG 1971
13	HURRICANE LILY	28 AUG - 31 AUG 1971
14	HURRICANE MONICA	29 AUG - 05 SEP 1971
15	HURRICANE NANETTE	05 SEP - 09 SEP 1971
16	TROPICAL DEPRESSION SIXTEEN	05 SEP - 06 SEP 1971
17	HURRICANE OLIVIA (FORMER IRENE)	20 SEP - 30 SEP 1971
18	HURRICANE PRISCILLA	06 OCT - 12 OCT 1971
19	TROPICAL DEPRESSION NINETEEN	13 OCT - 15 OCT 1971
20	TROPICAL DEPRESSION TWENTY	22 OCT - 23 OCT 1971
21	TROPICAL STORM RAMONA	28 OCT - 31 OCT 1971
22	TROPICAL STORM SHARON	26 NOV - 27 NOV 1971

TROPICAL DEPRESSIONS 1971
POSITION DATA

TROPICAL DEPRESSION SIX
14 - 17 JUL

DTG	LAT	LONG	DTG	LAT	LONG
141800Z	12.8N	125.8W	160600Z	12.7N	131.5W
150000Z	13.0N	127.0W	161200Z	12.6N	132.5W
150600Z	13.0N	128.0W	161800Z	13.1N	133.1W
151200Z	13.0N	129.0W	170000Z	13.1N	134.1W
151800Z	12.8N	129.5W	170600Z	13.1N	135.1W
160000Z	12.8N	130.5W	171200Z	13.0N	136.0W
			171800Z	12.3N	136.3W

TROPICAL DEPRESSION SIXTEEN
05-06 SEP

DTG	LAT	LONG	DTG	LAT	LONG
051800Z	15.7N	99.8W	060000Z	MERGED WITH T.S. NANETTE	

TROPICAL DEPRESSION NINETEEN
13-15 OCT

DTG	LAT	LONG	DTG	LAT	LONG
131800Z	12.8N	105.8W	150000Z	15.3N	107.1W
140000Z	13.2N	106.1W	150600Z	16.0N	107.3W
140600Z	13.7N	106.4W	151200Z	16.8N	107.4W
141200Z	14.2N	106.7W	151800Z	17.5N	107.2W
141800Z	14.6N	106.9W			

TROPICAL DEPRESSION TWENTY
22 - 23 OCT

DTG	LAT	LONG	DTG	LAT	LONG
221800Z	13.3N	113.2W	231200Z	14.5N	114.6W
230000Z	13.5N	113.7W	231800Z	15.0N	115.0W
230600Z	14.1N	114.2W			

TROPICAL STORMS 1971
POSITION DATA

TROPICAL STORM CARLOTTA
02 - 07 JUL

DTG	LAT	LONG
021800Z	11.0N	111.8W
030000Z	11.7N	112.7W
030600Z	12.2N	113.8W
031200Z	12.6N	114.9W
031800Z	13.2N	116.0W
040000Z	13.9N	117.0W
040600Z	14.7N	117.8W
041200Z	15.5N	118.6W
041800Z	16.3N	119.5W
050000Z	16.7N	120.3W
050600Z	17.0N	121.1W
051200Z	17.3N	122.0W
051800Z	17.6N	122.8W
060000Z	18.0N	123.7W
060600Z	18.1N	124.7W
061200Z	18.3N	125.7W
061800Z	18.7N	126.6W
070000Z	19.0N	127.5W
070600Z	19.1N	128.5W

TROPICAL STORM ELEANOR
08 - 11 JUL

DTG	LAT	LONG
081800Z	13.0N	115.0W
090000Z	13.2N	116.8W
090600Z	13.2N	118.6W
091200Z	13.3N	120.4W
091800Z	13.7N	122.2W
100000Z	14.0N	123.3W
100600Z	14.4N	124.5W
101200Z	14.7N	125.7W
101800Z	14.8N	127.2W
110000Z	14.3N	128.5W
110600Z	13.8N	129.9W
111200Z	13.3N	131.2W
111800Z	13.0N	132.7W

TROPICAL STORM GEORGETTE
23 - 27 JUL

DTG	LAT	LONG
230000Z	16.0N	113.0W
230600Z	16.0N	113.9W
231200Z	16.1N	114.7W
231800Z	16.3N	115.5W
240000Z	16.6N	116.2W
240600Z	17.0N	116.7W
241200Z	17.5N	117.1W
241800Z	18.1N	117.4W
250000Z	18.9N	118.2W
250600Z	19.4N	119.3W
251200Z	19.7N	120.4W
251800Z	20.0N	121.5W
260000Z	20.4N	122.6W
260600Z	20.8N	123.7W
261200Z	21.2N	124.8W
261800Z	21.4N	126.2W
270000Z	21.5N	127.7W
270600Z	21.8N	129.2W
271200Z	22.1N	130.7W
271800Z	22.2N	132.0W

TROPICAL STORM JEWEL
06 - 11 AUG

DTG	LAT	LONG	DTG	LAT	LONG
061800Z	15.5N	102.0W	090600Z	18.2N	110.6W
070000Z	15.5N	103.0W	091200Z	18.6N	111.5W
070600Z	15.7N	103.9W	091800Z	19.1N	112.4W
071200Z	15.9N	104.8W	100000Z	19.3N	112.9W
071800Z	16.1N	105.7W	100600Z	19.5N	113.5W
080000Z	16.4N	106.6W	101200Z	19.7N	114.1W
080600Z	16.9N	107.4W	101800Z	19.9N	114.7W
081200Z	17.3N	108.2W	110000Z	20.2N	115.5W
081800Z	17.6N	108.8W	110600Z	20.6N	116.3W
090000Z	17.9N	109.7W	111200Z	21.0N	117.0W

TROPICAL STORM KATRINA
11 - 12 AUG

DTG	LAT	LONG	DTG	LAT	LONG
10000Z	19.8N	107.3W	120000Z	23.5N	109.9W
10600Z	20.5N	108.2W	120600Z	24.7N	109.7W
11200Z	21.3N	109.1W	121200Z	25.7N	109.2W
11800Z	22.3N	109.7W			

TROPICAL STORM RAMONA
28 - 31 OCT

DTG	LAT	LONG	DTG	LAT	LONG
81800Z	11.8N	104.4W	301200Z	15.6N	109.3W
90000Z	12.5N	105.1W	301800Z	15.9N	110.0W
90600Z	13.3N	105.6W	310000Z	16.1N	110.8W
91200Z	14.0N	106.2W	310600Z	16.2N	111.5W
91800Z	14.7N	106.9W	311200Z	16.2N	112.3W
00000Z	15.0N	107.7W	311800Z	16.0N	113.0W
00600Z	15.3N	108.5W			

TROPICAL STORM SHARON
26 - 27 NOV

DTG	LAT	LONG	DTG	LAT	LONG
61200Z	10.0N	103.0W	270600Z	10.0N	106.3W
61800Z	10.0N	104.0W	271200Z	10.0N	107.5W
70000Z	10.0N	105.0W	271800Z	09.8N	108.5W

CENTRAL NORTH PACIFIC

Fleet Weather Central, Pearl Harbor issued warnings on three tropical cyclones in 1971. Only one of these systems, tropical depression Two Four, originated in the Central Pacific. The remaining two systems, hurricane Denise and tropical storm Hilary, developed in the Fleet Weather Central, Alameda area of responsibility. Tropical storm Hilary, previously hurricane Hilary, existed only as a tropical storm in the Central Pacific. Hurricane Denise became Fleet Weather Central, Pearl Harbor's responsibility as such and progressed downward through the stages of tropical storm and tropical depression.

Total Number of Warnings	19
Calendar Days of Warnings	8
Tropical Depressions	1
Tropical Storms	1
Hurricanes	1
Total Tropical Cyclones	3

No damage resulting from tropical cyclone activity was reported during 1971. Tropical depression Two Four was first detected by satellite and all warnings were based on information provided by ESSA-8. One reconnaissance flight was scheduled, however dissipation occurred prior to this mission. Tropical storm Hilary curved north and dissipated 12 hours after acceptance of warning responsibility.

All warnings were coordinated with the Central Pacific Hurricane Center, Honolulu in accordance with the National Hurricane Operations Plan. The main forecasting tool utilized by Fleet Weather Central, Pearl Harbor was TYRACK, a computerized forecasting system based on tropical wind fields.

TROPICAL CYCLONES FOR THE 1971 SEASON

CYCLONE	PERIOD
HURRICANE DENISE	10-13 JUL
TROPICAL STORM HILARY	5-6 AUG
TROPICAL DEPRESSION TWO FOUR	23-24 AUG

INDIVIDUAL HURRICANE TRACKS

FOR 1971

IN THE EASTERN AND CENTRAL NORTH PACIFIC OCEAN

HURRICANE AGATHA

221800Z MAY TO 241800Z MAY 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 9
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 1
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 360 MILES

B. CHARACTERISTICS

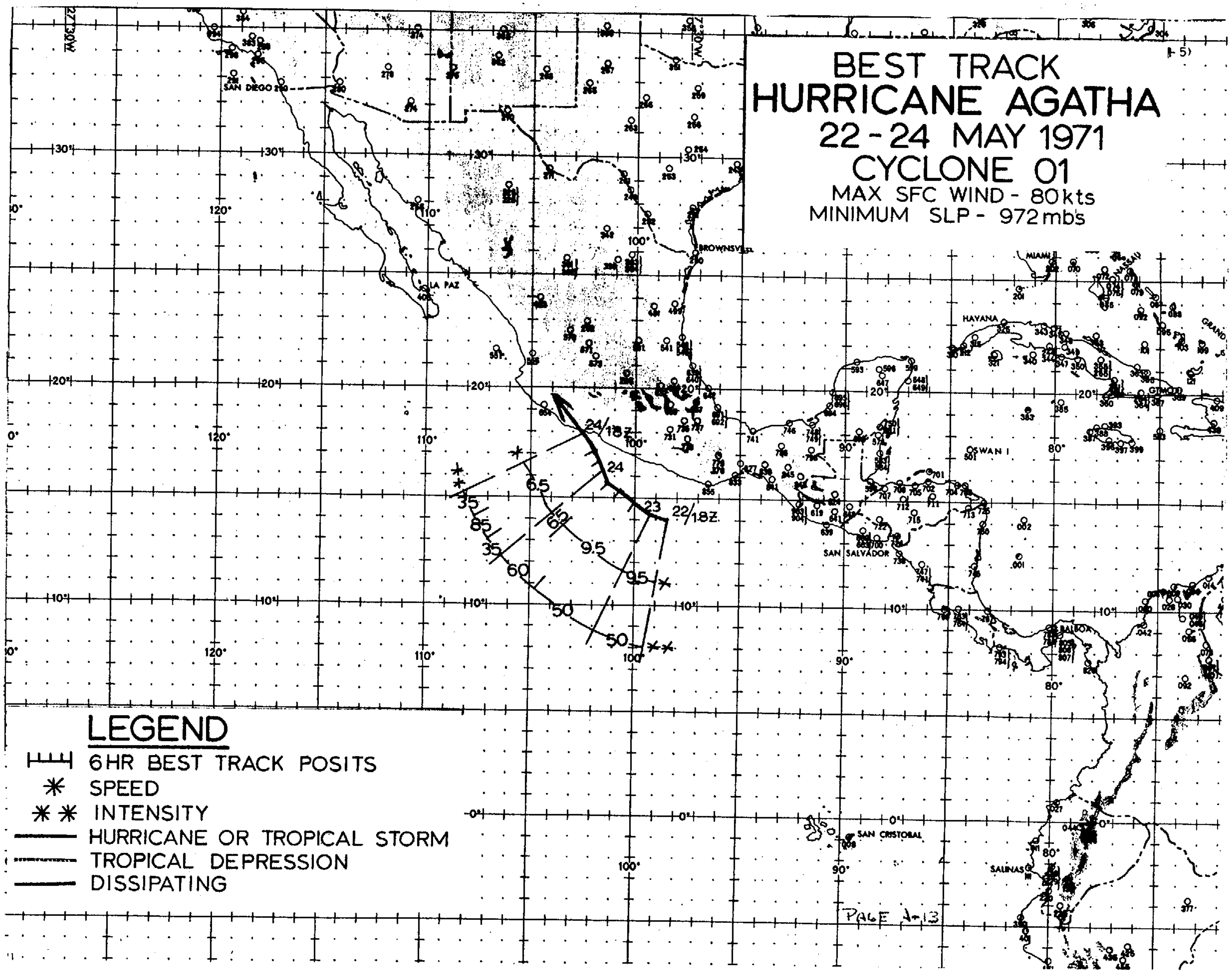
1. MINIMUM OBSERVED SLP - 972.0 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 80 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 240 MI.

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX: 221600Z (ATS-3)
C. TIME STORM REACHED HURRICANE INTENSITY: 241200Z

III. FINAL DISPOSITION

A. DISSIPATED NEARLY 120 MILES NORTHWEST OF ACAPULCO, ONSHORE


BEST TRACK
HURRICANE AGATHA
22 - 24 MAY 1971
CYCLONE 01
MAX SFC WIND - 80kts
MINIMUM SLP - 972mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
24/18Z
22/18Z
SAN DIEGO
LA PAZ
BROWNSVILLE
HAVANA
MIAMI
SAN SALVADOR
SWAN I
BALBOA
SAN CRISTOBAL
SALINAS
GTMO
PAGE A-13

HURRICANE AGATHA
POSITION FROM BEST TRACK AND VERIFICATION DATA

	STORM POSIT		24 HR ERROR	48 HR ERROR
TIME	LAT	LONG	DEG/DIST.	DEG/DIST.
221800Z	14.1N	98.3W	-	
230000Z	14.3N	99.2W	-	
230600Z	14.8N	100.0W	-	
231200Z	15.3N	100.7W	-	
231800Z	15.8N	101.2W	312/064	
240000Z	16.3N	101.5W	248/127	
240600Z	16.7N	101.7W	248/135	
241200Z	17.2N	101.9W	272/228	
241800Z	18.0N	102.5W	232/090	279/182

24 HOUR FORECAST ERROR = 124.8 MI
48 HOUR FORECAST ERROR = 182.0 MI

EYE FIXES TROPICAL CYCLONE #1 (HURRICANE AGATHA)

FIX NO.	TIME	POSIT	UNIT/ACCURACY		FLT LVL	MAX OBS SFC WND	SLP	EYE FORM	EYE DIAM
1	231740Z	15.8N 101.2W	9th AF	5NM	500/300MB	60KTS	972?	C	12-15NM
2.	241707Z	18.0N 102.5W	9th AF	1NM	500/300MB	35KTS	N/A	C	15-20NM

HURRICANE BRIDGET

141800Z JUN TO 171800Z JUN 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 13
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 5
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 910 MILES

B. CHARACTERISTICS

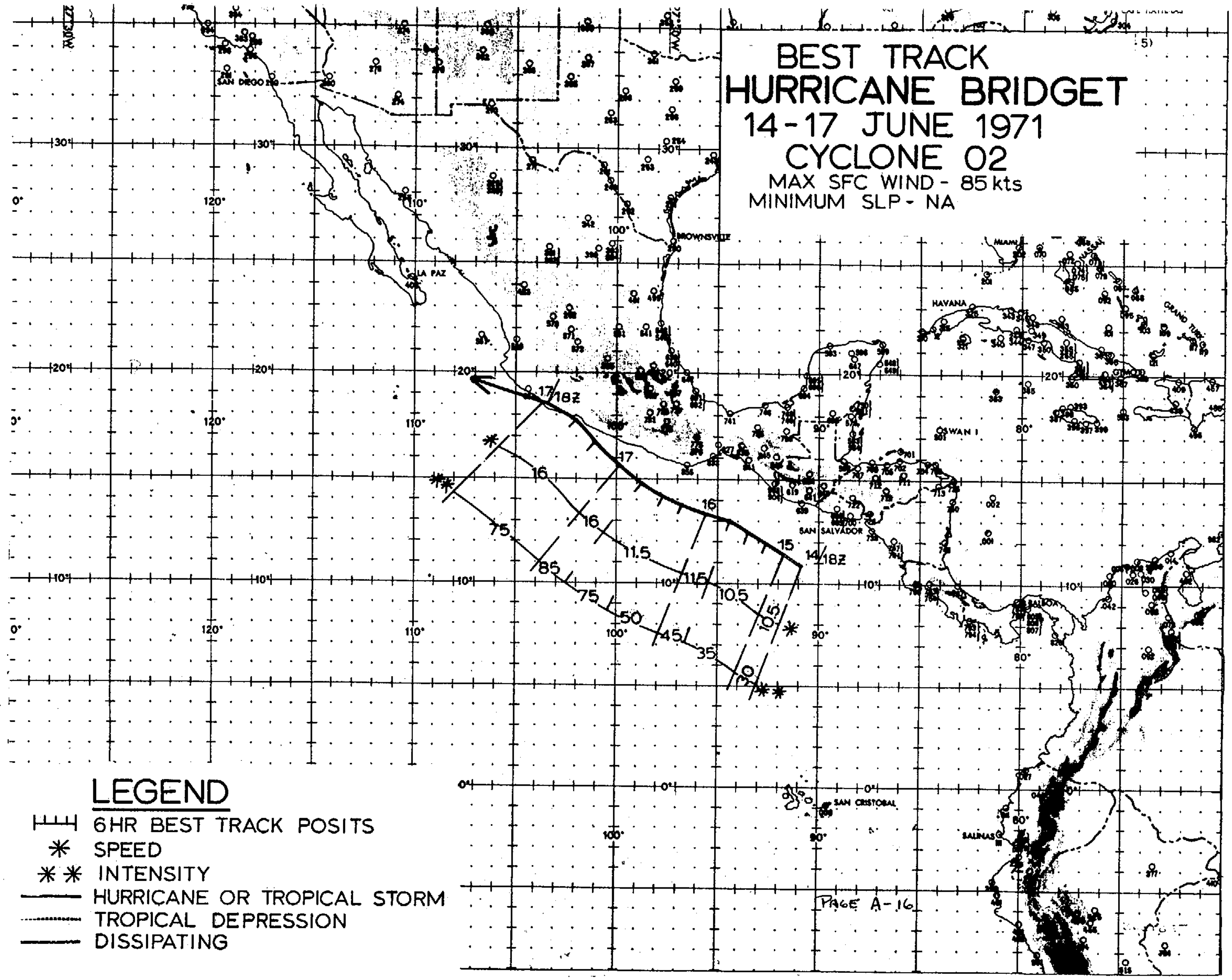
1. MINIMUM OBSERVED SLP - NOT OBSERVED
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 85 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX: 141800Z (ESSA -8)
C. TIME STORM REACHED HURRICANE INTENSITY: 161200Z

III. FINAL DISPOSITION

A. DISSIPATED OVER WATER NEAR 18.5N 107.5W


BEST TRACK
HURRICANE BRIDGET
14-17 JUNE 1971
CYCLONE 02
MAX SFC WIND - 85 kts
MINIMUM SLP - NA
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
PAGE A-16

HURRICANE BRIDGET

POSITION FROM BEST TRACK AND VERIFICATION DATA
141800Z to 171800Z JUNE 1971

STORM POSIT			24 HR ERROR	48 HR ERROR
TIME	LAT	LONG	DEG/DIST	DEG/DIST
141800Z	10.9N	90.9W	-	-
150000Z	11.5N	91.8W	-	-
150600Z	12.0N	92.7W	-	-
151200Z	12.5N	93.6W	-	-
151800Z	13.1N	94.5W	220/047	-
160000Z	13.4N	95.6W	017/045	-
160600Z	13.8N	96.7W	210/096	-
161200Z	14.2N	97.8W	105/051	-
161800Z	14.7N	98.7W	112/078	-
170000Z	15.7N	99.9W	110/018	154/068
170600Z	16.8N	101.1W	140/068	186/225
171200Z	17.8N	102.3W	162/162	148/162
171800Z	18.6N	103.7W	130/120	140/230

24 HR FORECAST ERROR = 76.1MI
48 HR FORECAST ERROR = 171.2MI

NO USEABLE EYE FIXES DUE TO POOR RADAR PRESENTATION AND PROXIMITY TO MEXICAN COAST

HURRICANE DENISE
FLEWEACEN ALAMEDA
041800Z TO 101800Z JUL 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 25
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 15
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - (ALAMEDA AREA ONLY) 1920 MILES

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 970 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WINDS - 110 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 480 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 041800Z (ESSA 8)
C. TIME STORM REACHED HURRICANE INTENSITY - 061800Z

III. FINAL DISPOSITION

A. DISSIPATED IN CENTRAL PACIFIC AREA (PASSED TO HAWAII)

HURRICANE DENISE
FLEWEACEN PEARL HARBOR
110000Z TO 131800Z JUL 1971

I DATA

A. STATISTICS

1. Number of warnings issued - 12
2. Number of warnings with hurricane intensity - 7
3. Total distance traveled during tropical warning period - 890 miles

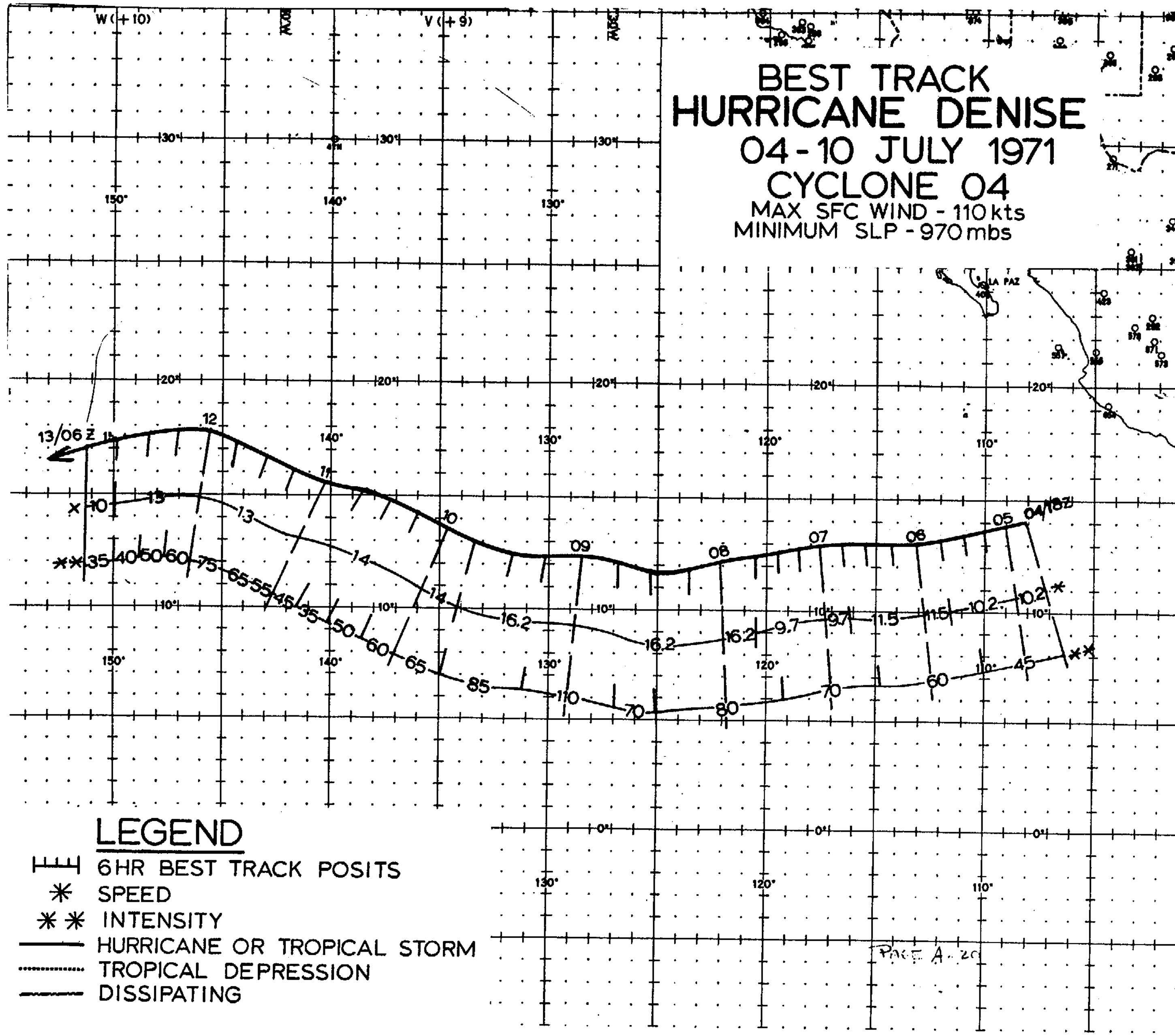
B. CHARACTERISTICS

1. Minimum Observed SLP - 993MB
2. Minimum Observed 700MB Height - 2762M
3. Maximum Surface Wind - 100 kts

II. DEVELOPMENT - Refer to FLEWEACEN ALAMEDA data.

III. FINAL DISPOSITION

A. Dissipated over water


BEST TRACK
HURRICANE DENISE
04-10 JULY 1971
CYCLONE 04
MAX SFC WIND - 110 kts
MINIMUM SLP - 970 mbs
13/06Z
04/18Z
LA PAZ
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING

HURRICANE DENISE

	STORM POSIT		24 HR	48 HR	72 HR
TIME	LAT	LONG	DEG/DIST	DEG/DIST	DEG/DIST
041800Z	14.0N	108.0W	-	-	-
050000Z	13.9N	109.0W	-	-	-
050600Z	13.8N	110.0W	-	-	-
051200Z	13.5N	111.0W	-	-	-
051800Z	13.2N	112.0W	349/147	-	-
060000Z	13.0N	113.1W	351/181	-	-
060600Z	13.0N	114.3W	353/205	-	-
061200Z	13.0N	115.5W	348/168	-	-
061800Z	13.0N	116.6W	070/038	354/252	-
070000Z	13.0N	117.6W	070/039	352/276	-
070600Z	12.9N	118.5W	080/133	351/302	-
071200Z	12.7N	119.5W	075/115	342/246	-
071800Z	12.5N	120.5W	346/033	033/051	-
080000Z	12.2N	122.1W	045/050	048/090	357/378
080600Z	11.9N	123.7W	058/093	073/261	-
081200Z	11.8N	125.3W	064/111	069/237	358/282
081800Z	12.1N	126.9W	096/145	067/145	-
090000Z	12.4N	128.5W	102/194	090/183	076/216
090600Z	12.4N	130.1W	103/226	090/219	-
091200Z	12.5N	131.8W	104/270	094/256	082/374
091800Z	13.0N	133.3W	179/060	104/295	-
100000Z	13.6N	134.7W	187/096	118/360	107/345
100600Z	14.3N	136.0W	193/144	122/395	-
101200Z	14.9N	137.2W	201/155	120/405	117/396
101800Z	15.4N	138.4W	204/058	205/192	-

PASSED TO FLEWEACEN PEARL HARBOR

FORECAST ERROR 24 HR = 126.7 MI
48 HR = 245.0 MI
72 HR = 331.8 MI

EYE FIXES TROPICAL CYCLONE #4 (HURRICANE DENISE)

NO.	TIME	POSIT	ACC.	LVL	SFC WND	FORM	EYE DIAM
1	051917Z	13.2N 112.3W	7NM	300/500	60	C	-
2	061750Z	13.0N 116.6W	10NM	300	70	C	25MI
3	071740Z	12.5N 120.5W	10NM	300/700	80	C	40MI
4	081933Z	12.1N 127.3W	10NM	300/700	110	C	20MI
5	091825Z	13.0N 133.3W	10NM	300/700	85	C	-
6	101815Z	15.7N 137.6W	25NM	300/700	100	E	090/30/25
7	111800Z	17.2N 144.2W	-	-	75	-	-

HURRICANE DENISE
POSITION FROM BEST TRACK AND VERIFICATION DATA

TIME	LAT	LONG	DEG/DIST
110000Z	15.5N	140.3W	360/060
110600Z	16.1N	141.6W	037/099
111200Z	16.7N	142.9W	011/190
111800Z	17.2N	144.2W	032/177
120000Z	17.8N	145.6W	023/130
120600Z	17.8N	147.0W	001/205
121200Z	17.6N	148.4W	354/273
121800Z	17.3N	149.8W	302/120
130000Z	17.0N	151.2W	DSPTD

24 HOUR FORECAST ERROR = 157 MI

EYE FIXES HURRICANE DENISE

	FIX NO.	TIME	POSIT	UNIT METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	EYE DIA	THKNS WALL CLOUD
#1	06-10	101815Z	15.7N 137.6W	AF-RADAR-PENE-25MI	700MB	100	100	-X-	2762	12/5	E	30X25	PRLY DEFINED WALL CLD AT FLT LVL
#2	07-04	111804Z	17.3N 144.2W	AF-RADAR-PENE-10MI	700MB	70	75	993MB	2987	13/7	C	30	- - -
#3	08-03	121800Z	17.3N 149.8W	AF-PENE-10MI	700MB	48	40	999MB	3103	7/5	C	30	NO APRNT WALL CLDS
#4	XX-04	130340Z	16.8N 151.3W	AF-PENE-10MI	700MB	36	35	1004MB	3136	13/13	C	40	- - -
#5	01-11	131910Z	16.0N 153.3W	AF-RADAR-10MI	700MB	05	X	X	3116	06/X			CNTR ILL DEFINED. NO DEFINITION

HURRICANE FRANCENE

181800Z JUL TO 250000Z JUL 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 27
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 4
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1440 MILES

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 995 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 100 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MILES

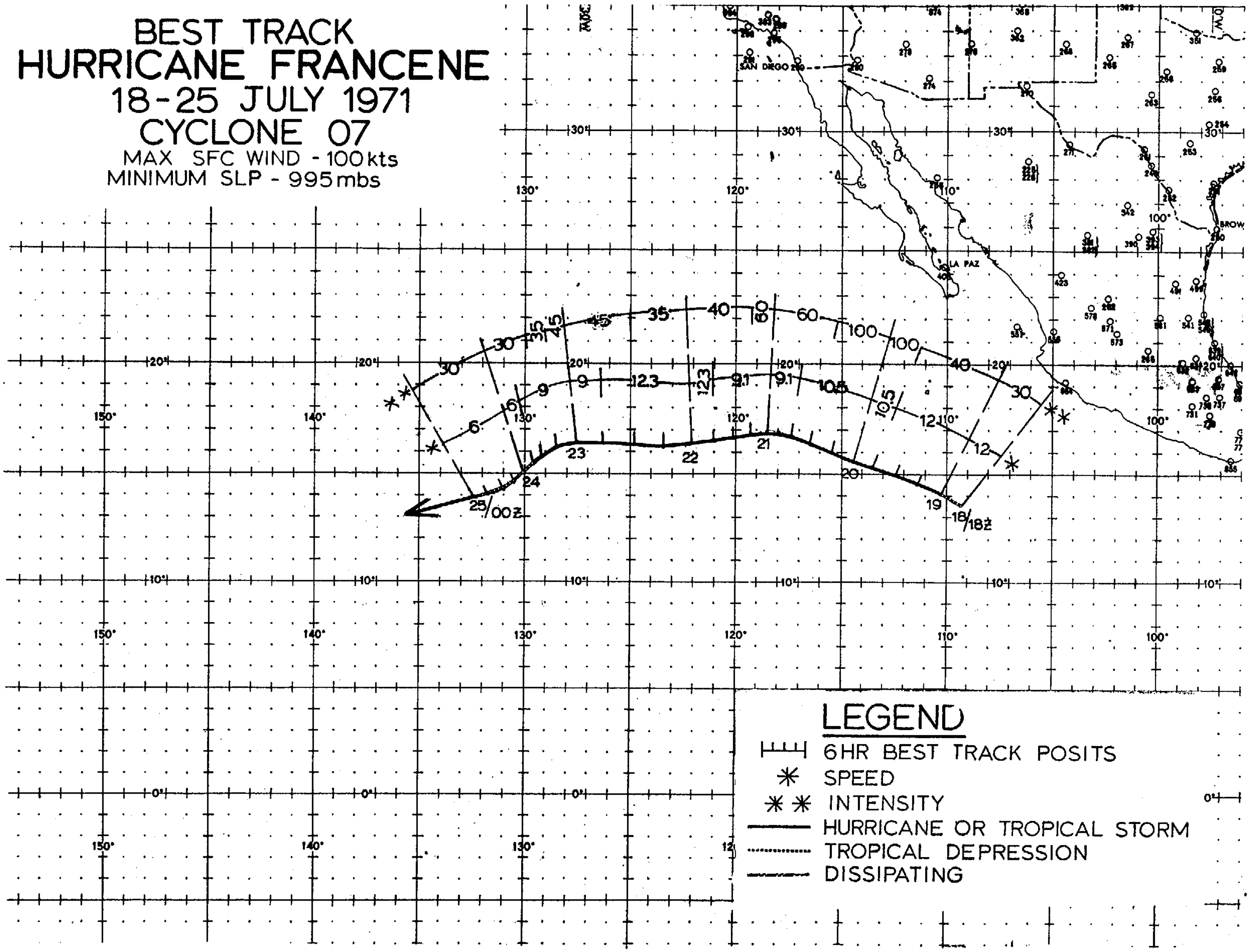
II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 181800Z
C. TIME STORM REACHED HURRICANE INTENSITY - 191800Z

III. FINAL DISPOSITION

A. DISSIPATED OVER WATER NEAR 14.0N 133.0W

BEST TRACK
HURRICANE FRANCENE
18-25 JULY 1971
CYCLONE 07
MAX SFC WIND - 100kts
MINIMUM SLP - 995mbs



HURRICANE FRANCENE

POSITION FROM BEST TRACK AND VERIFICATION DATA

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
181800Z	13.7N	109.2W	-	-	-
190000Z	14.1N	110.3W	-	-	-
190600Z	14.6N	111.4W	-	-	-
191200Z	15.0N	112.5W	-	-	-
191800Z	15.3N	113.6W	154/219	-	-
200000Z	15.6N	114.5W	164/194	-	-
200600Z	16.0N	115.5W	165/216	-	-
201200Z	16.4N	116.5W	167/242	-	-
201800Z	16.8N	117.4W	217/099	-	-
210000Z	17.0N	118.3W	180/068	171/275	-
210600Z	16.9N	119.2W	212/064	172/267	-
211200Z	16.8N	120.1W	227/063	173/261	-
211800Z	16.6N	121.0W	250/075	289/159	-
220000Z	16.4N	122.1W	027/108	270/048	173/235
220600Z	16.2N	123.4W	027/147	265/066	-
221200Z	16.3N	124.8W	025/180	258/054	162/237
221800Z	16.4N	126.2W	033/207	253/042	-
230000Z	16.5N	127.4W	103/158	037/210	260/117
230600Z	16.3N	128.5W	095/150	035/250	-
231200Z	15.9N	129.1W	085/126	020/279	278/162
231800Z	15.5N	129.6W	086/144	017/312	-
240000Z	15.1N	130.0W	062/114	095/090	360/366
240600Z	14.7N	130.5W	354/078	015/081	-
241200Z	14.3N	131.0W	354/068	-	-
241800Z	14.1N	131.7W	333/080	-	-
250000Z	14.0N	132.4W	238/270	308/195	-

FORECAST ERROR: 24 HR ERROR = 139.5 MI
48 HR ERROR = 172.6 MI
72 HR ERROR = 223.4 MI

FIX NO.	TIME	POSIT	UNIT/ACCURACY	FLT LVL	MAX OBS SFC WND	SLP	EYE	DIAM
1	191745Z	15.3N 113.6W	9thAF/05 NM	500/300 MB	100 KTS	995MB	C	25 NM
2	201818Z	16.8N 117.4W	9thAF/10 NM	500/700 MB	60 KTS	MISG	C	35 NM
3	211800Z	16.6N 121.0W	9thAF/05 NM	500/700 MB	40 KTS	MISG	C	30 NM
4	221918Z	16.4N 126.2W	9thAF/10 NM	500/700 MB	45 KTS	995MB	C	45 NM

HURRICANE HILARY

261800Z JUL TO 060000Z AUG 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 42
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 26
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1920 MI.

B. CHARACTERISTICS

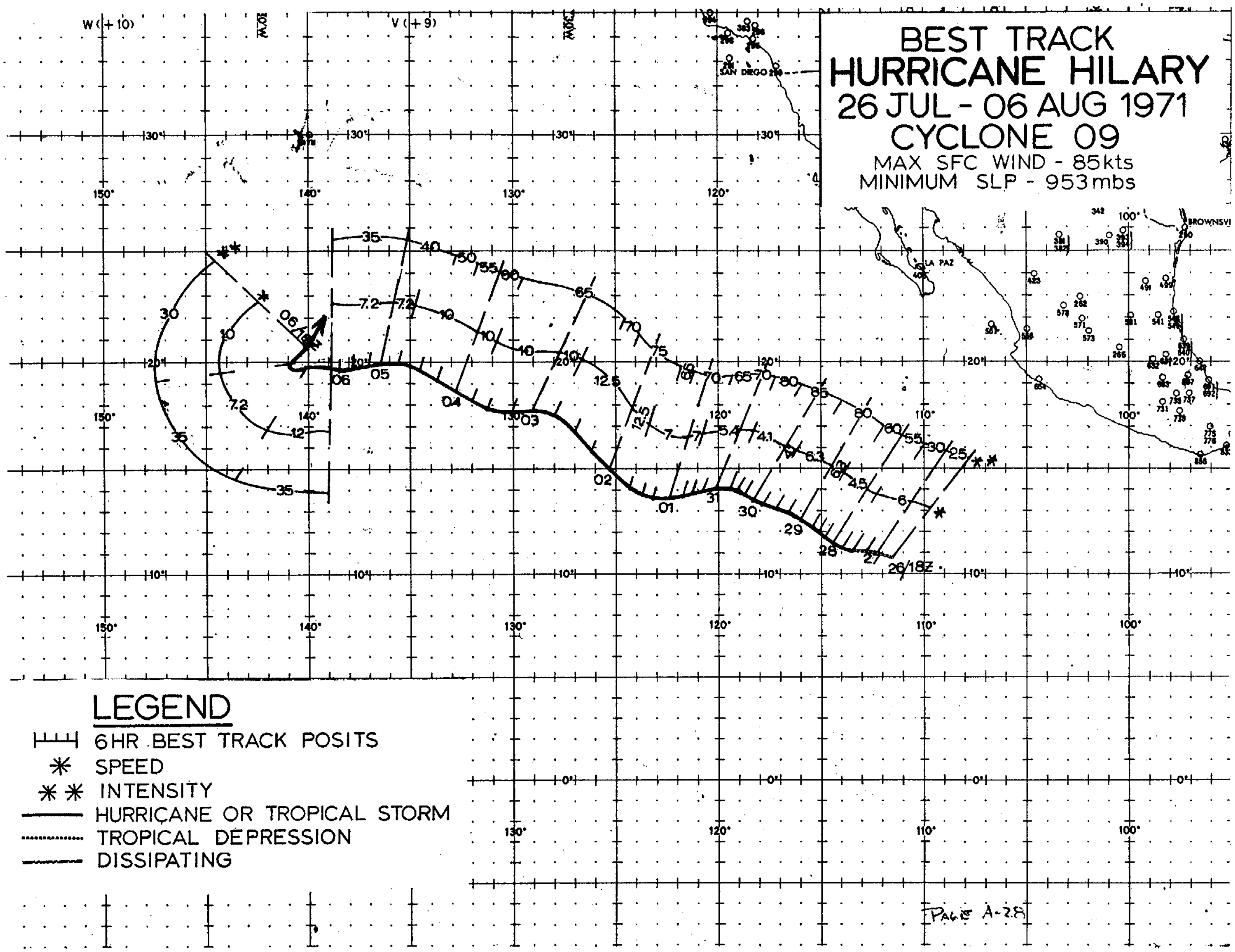
1. MINIMUM OBSERVED SLP - 953 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 85 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 261800Z
C. TIME STORM REACHED HURRICANE VELOCITY - 281800Z

III. FINAL DISPOSITION

A. PASSED TO FLEWEACEN PEARL(DISSIPATED NORTHEAST OF HAWAII)


BEST TRACK
HURRICANE HILARY
26 JUL - 06 AUG 1971
CYCLONE 09
MAX SFC WIND - 85kts
MINIMUM SLP - 953mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
W (+10)
V (+9)
SAN DIEGO
LA PAZ
PAGE A-28

HURRICANE HILARY

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
261800Z	10.8N	111.6W	-	-	-
270000Z	11.0N	112.2W	-	-	-
270600Z	11.1N	112.8W	-	-	-
271200Z	11.2N	113.4W	-	-	-
271800Z	11.3N	114.0W	200/038	-	-
280000Z	11.5N	114.5W	224/051	-	-
280600Z	11.7N	114.9W	231/068	-	-
281200Z	12.0N	115.2W	243/098	-	-
281800Z	12.3N	115.5W	265/096	-	-
290000Z	12.6N	116.0W	260/116	-	-
290600Z	12.9N	116.6W	259/127	-	-
291200Z	13.1N	117.2W	264/133	-	-
291800Z	13.3N	117.9W	044/022	262/128	-
300000Z	13.5N	118.3W	011/026	262/162	-
300600Z	13.8N	118.7W	344/024	265/188	-
301200Z	13.9N	119.0W	335/038	264/213	-
301800Z	14.1N	119.4W	280/074	330/048	-
310000Z	14.1N	120.1W	295/070	351/063	270/240
310600Z	14.0N	120.7W	295/102	354/082	-
311200Z	13.9N	121.2W	305/095	356/110	275/265
311800Z	13.8N	121.7W	025/130	315/130	-
010000Z	13.7N	122.4W	034/114	297/172	355/171
010600Z	13.7N	123.1W	032/132	296/194	-
011200Z	13.8N	123.8W	037/140	301/190	006/190
011800Z	14.1N	124.4W	144/047	035/214	-
020000Z	15.0N	125.3W	156/095	041/110	270/222
020600Z	15.9N	126.1W	164/159	051/105	-
021200Z	16.8N	127.0W	157/219	092/166	265/207
021800Z	17.6N	128.0W	165/198	162/285	-
030000Z	17.9N	129.0W	162/220	158/306	115/132
030600Z	17.7N	130.1W	153/219	147/315	-
031200Z	17.9N	131.2W	153/229	146/339	095/320
031800Z	18.3N	132.0W	023/015	149/255	-
040000Z	18.8N	132.8W	295/033	152/279	153/400
040600Z	19.3N	133.7W	275/042	155/312	-
041200Z	19.7N	134.6W	268/050	154/324	155/459
041800Z	20.1N	135.6W	210/040	026/174	-
050000Z	20.1N	136.4W	215/069	296/046	149/360
050600Z	19.9N	137.1W	235/065	315/070	-
051200Z	19.7N	137.8W	268/075	305/115	155/330
051800Z	19.6N	138.5W	285/070	305/110	-
060000Z	19.8N	138.9W	289/102	270/130	320/170

HURRICANE HILARY

FORECAST ERROR: 24 HR ERROR = 95.8 MI
48 HR ERROR = 177.8 MI
72 HR ERROR = 266.6 MI

FIX NO.	TIME	POSIT	UNIT/ACCURACY		FLT LVL	MAX OBS SFC WND	SLP	EYE	DIAM
1	271800Z	11.3N 113.9W	9thAF	10NM	300/500 MB	55 KTS	N/A	C	30 NM
2	281740Z	12.3N 115.5W	9thAF	10NM	300/700 MB	80 KTS	964MB	C	13 NM
3	291745Z	13.3N 117.9W	9thAF	2NM	300/400 MB	85 KTS	N/A	C	20 NM
4	301753Z	14.5N 119.6W	9thAF	5NM	300/700 MB	70 KTS	N/A	E	092/25/15
5	311905Z	13.8N 121.6W	9thAF	5NM	300/500 MB	70 KTS	968MB	C	25 NM
6	011801Z	14.1N 124.4W	9thAF	5NM	300/500 MB	75 KTS	953MB	C	22 NM
7	022000Z	17.8N 128.2W	9thAF	10NM	300/500 MB	65 KTS	N/A	C	20 NM
8	031722Z	18.3N 132.0W	9thAF	5NM	300/700 MB	65 KTS	N/A	C	15 NM
9	041800Z	20.1N 135.6W	9thAF	5NM	300/500 MB	40 KTS	995MB	C	20 NM
10	051705Z	19.6N 138.5W	9thAF	5NM	300/500 MB	35 KTS	1002MB	C	20 NM

TROPICAL STORMS 1971
POSITION DATA
TROPICAL STORM HILARY
06 AUG

DTG	LAT	LONG
060600Z	19.8N	140.1W
061200Z	19.9N	140.8W
061800Z	20.5N	140.0W

TROPICAL DEPRESSIONS 1971
POSITION DATA
TROPICAL DEPRESSION TWO FOUR
24 AUG

DTG	LAT	LONG
240000Z	14.5N	147.0W
240600Z	14.5N	148.0W
241200Z	14.5N	149.1W
241800Z	14.5N	149.5W

HURRICANE ILSA

311800Z JUL TO 080000Z AUG 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 30
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 14
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1620 MI.

B. CHARACTERISTICS

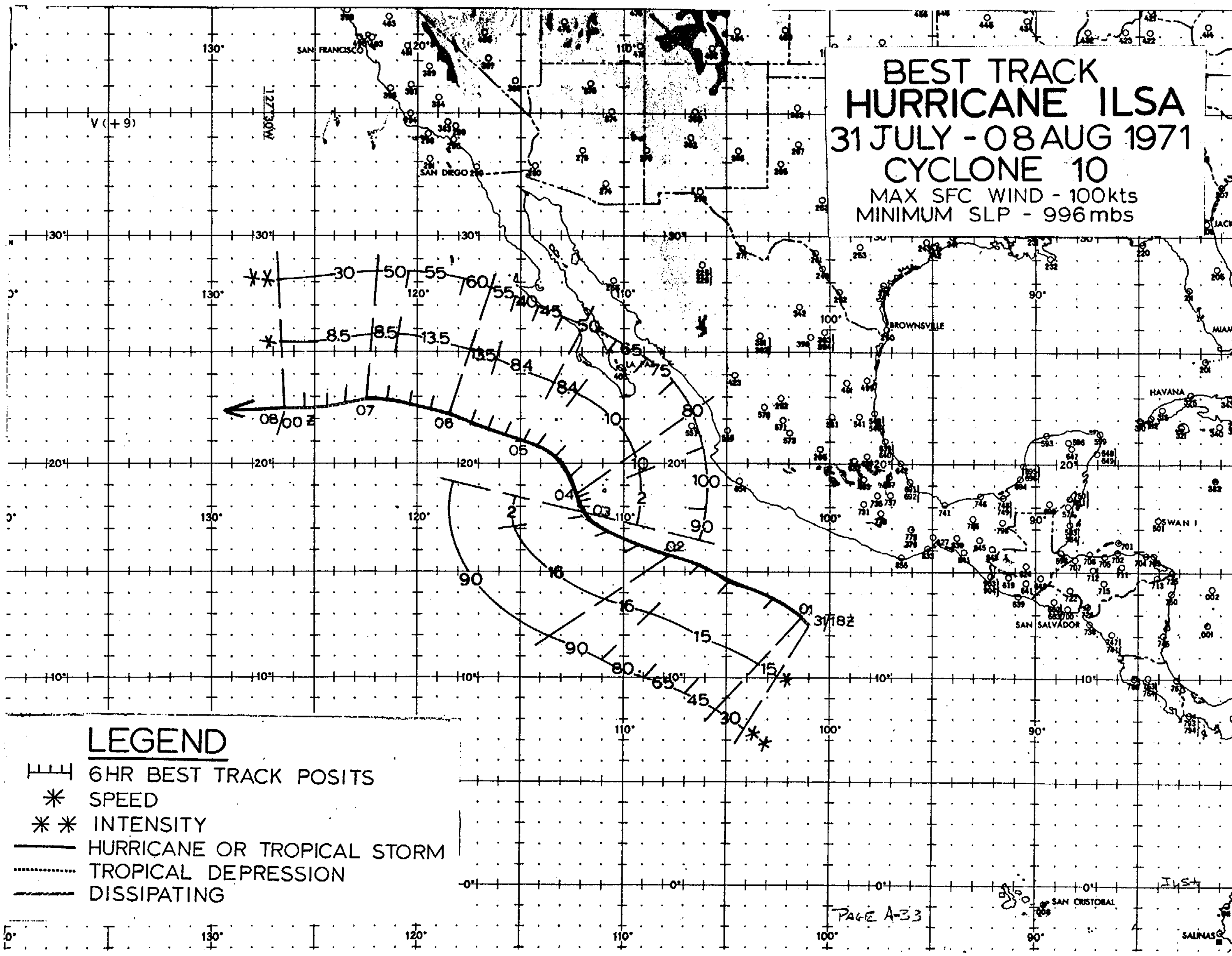
1. MINIMUM OBSERVED SLP - 996 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 100 KTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 350 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 311800Z
C. TIME STORM REACHED HURRICANE INTENSITY - 010600Z

III. FINAL DISPOSITION

A. DISSIPATED OVER WATER NEAR 23.0N 126.0W


BEST TRACK
HURRICANE ILSA
31 JULY - 08 AUG 1971
CYCLONE 10
MAX SFC WIND - 100kts
MINIMUM SLP - 996mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
SAN FRANCISCO
SAN DIEGO
BROWNSVILLE
MIAMI
HAVANA
SWAN I.
SAN SALVADOR
SAN CRISTOBAL
SALINAS
PAGE A-33

HURRICANE ILSA

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
311800Z	12.5N	101.0W	-	-	-
010000Z	12.9N	102.4W	-	-	-
010600Z	13.7N	103.7W	-	-	-
011200Z	14.5N	105.0W	-	-	-
011800Z	15.2N	106.3W	145/147	-	-
020000Z	15.7N	107.7W	145/177	-	-
020600Z	16.2N	109.2W	183/132	-	-
021200Z	16.8N	110.7W	139/063	-	-
021800Z	17.6N	112.0W	001/054	-	-
030000Z	17.8N	112.1W	321/114	153/260	-
030600Z	18.0N	112.1W	306/190	211/249	-
031200Z	18.2N	112.1W	295/165	079/153	-
031800Z	18.4N	112.1W	266/132	295/334	-
040000Z	18.6N	112.1W	302/168	299/450	204/297
040600Z	19.5N	112.5W	295/186	290/450	-
041200Z	20.3N	113.2W	290/195	271/318	077/357
041800Z	20.7N	114.1W	094/138	250/252	-
050000Z	21.0N	114.9W	108/138	304/195	278/585
050600Z	21.3N	115.7W	104/177	309/200	-
051200Z	21.5N	116.5W	099/210	302/237	258/402
051800Z	21.8N	117.3W	033/180	084/290	-
060000Z	22.2N	118.4W	090/196	095/314	325/230
060600Z	22.4N	119.4W	087/234	091/358	-
061200Z	22.6N	120.4W	085/265	090/414	321/270
061800Z	22.9N	121.4W	310/048	039/354	-
070000Z	22.9N	122.4W	336/043	083/354	088/515
070600Z	22.8N	123.4W	329/090	080/390	-
071200Z	22.7N	124.4W	335/126	076/438	082/627
071800Z	22.6N	125.4W	335/165	335/156	-
080000Z	22.6N	126.4W	355/150	353/186	-

FORECAST ERROR: 24 HR = 149.3 MI
48 HR = 303.0 MI
72 HR - 410.3 MI

EYE FIXES, TROPICAL CYCLONE #10 (HURRICANE ILSA)

No.	TIME	POSIT	ACC.	FLT LVL	SFC WND	EYE	DIAM
1	012200Z	14.2N 108.4W	5 NM	300/500 MB	55 KTS	C	40 NM
2	021730Z	17.6N 112.0W	15 NM	300/500 MB	MISG	C	30 NM
3	032223Z	18.5N 112.1W	10 NM	300/500 MB	65 KTS	C	50 NM
4	041442Z	20.5N 113.6W	5 NM	300/500 MB	50 KTS	C	30 NM
5	042110Z	20.6N 113.6W	10 NM	300/500 MB	45 KTS	C	50 NM (ESTIMATED
6	051637Z	21.8N 117.0W	29 NM	300/500 MB	55 KTS	C	30 NM
7	052103Z	22.1N 117.9W	3 NM	500/700 MB	60 KTS	E	090/200 12 NM

HURRICANE LILY

281800Z AUG TO 311800Z AUG 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 13
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 5
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 900 MILES

B. CHARACTERISTICS

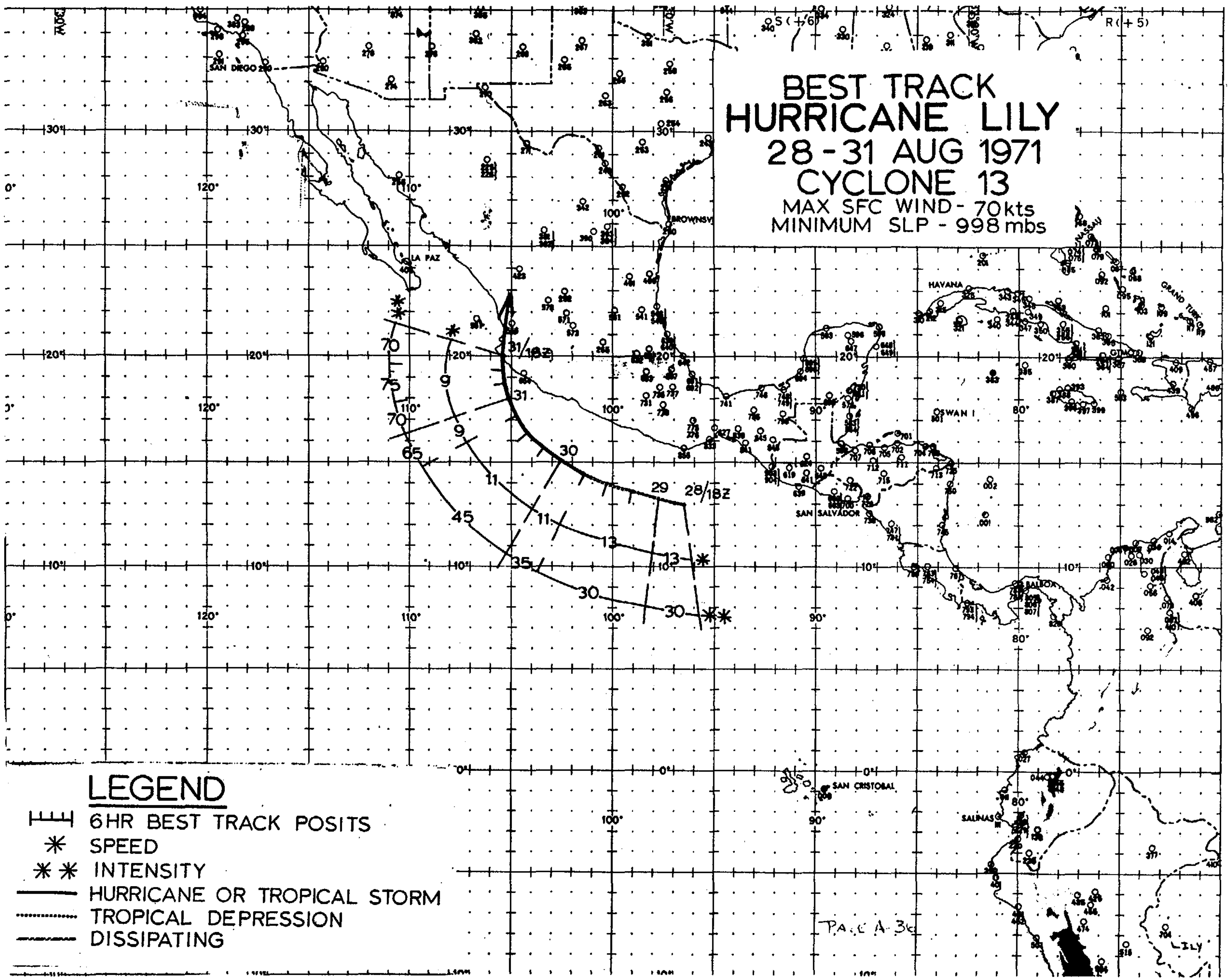
1. MINIMUM OBSERVED SLP - 998 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WINDS - 70 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 240 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 281800Z
C. TIME STORM REACHED HURRICANE INTENSITY - 301800Z

III. FINAL DISPOSITION

A. DISSIPATED OVER MOUNTAINS OF MEXICO NEAR 20.0N 105.0W


BEST TRACK
HURRICANE LILY
28-31 AUG 1971
CYCLONE 13
MAX SFC WIND - 70kts
MINIMUM SLP - 998 mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
28/18Z
31/18Z
SAN DIEGO
LA PAZ
HAVANA
SAN SALVADOR
SAN CRISTOBAL
SALINAS
Page A-36

HURRICANE LILY

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST
281800Z	13.0N	96.5W	-	-
290000Z	13.2N	97.8W	-	-
290600Z	13.6N	99.0W	-	-
291200Z	14.1N	100.2W	-	-
291800Z	14.6N	101.5W	105/062	-
300000Z	15.1N	102.5W	136/105	-
300600Z	15.7N	103.4W	161/134	-
301200Z	16.4N	104.2W	144/082	-
301800Z	17.2N	104.8W	090/030	-
310000Z	18.0N	105.1W	230/072	-
310600Z	18.7N	105.3W	205/112	-
311200Z	19.4N	105.4W	250/170	-
311800Z	20.0N	105.3W	260/213	260/194

EYE FIXES, TROPICAL CYCLONE #13 (LILY)

NO.	TIME	POSIT	ACC.	FLT LVL	SFC WND	EYE	DIAM
1	301700Z	17.2N 104.8W	5NM	300/700MB	65 KTS	C	35 NM
2	311725Z	20.0N 105.3W	10NM	500/700MB	65 KTS	C	40 NM

HURRICANE MONICA

291800Z AUG TO 050000Z SEP 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 26
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 13
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 800 MI.

B. CHARACTERISTICS

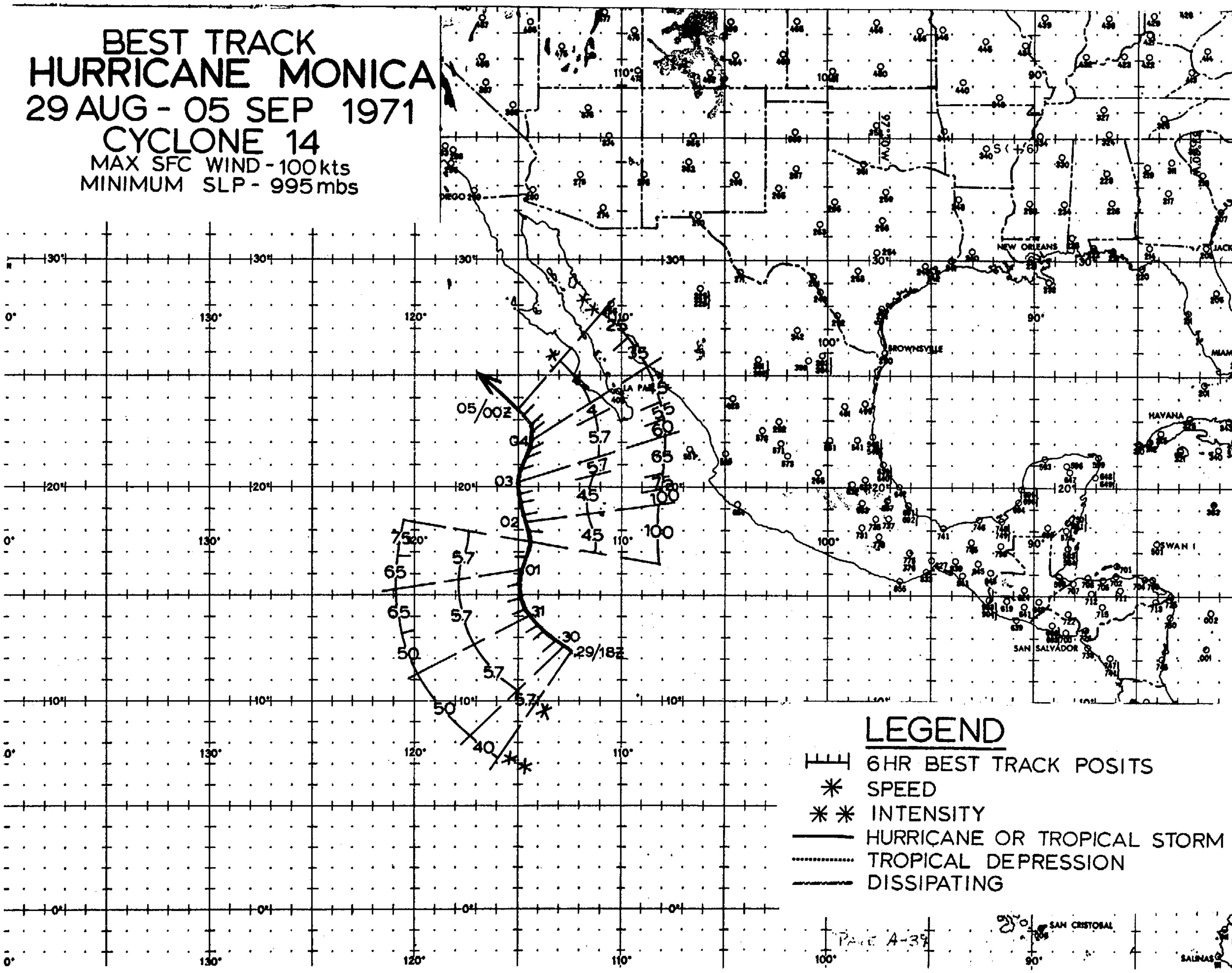
1. MINIMUM OBSERVED SLP - 995 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 100 KTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 250 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 291800Z
C. TIME STORM REACHED HURRICANE INTENSITY - 311800Z

III. FINAL DISPOSITION

A. DISSIPATED OVER WATER NEAR 24.0N 115.0W


BEST TRACK
HURRICANE MONICA
29 AUG - 05 SEP 1971
CYCLONE 14
MAX SFC WIND - 100 kts
MINIMUM SLP - 995 mbs
05/00Z
04
03
02
01
31
30
29/18Z
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
LA PAZ
BROWNSVILLE
NEW ORLEANS
HAVANA
MIAMI
SAN SALVADOR
SAN CRISTOBAL
SALINAS
PAGE A-39

HURRICANE MONICA 291800Z AUG - 050000Z SEP 1971

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
291800Z	12.3N	112.3W	-	-	-
300000Z	12.6N	112.8W	-	-	-
300600Z	12.9N	113.2W	-	-	-
301200Z	13.3N	113.7W	-	-	-
301800Z	13.6N	114.0W	253/220	-	-
310000Z	14.0N	114.4W	257/267	-	-
310600Z	14.4N	114.7W	245/225	-	-
311200Z	14.9N	114.9W	244/297	-	-
311800Z	15.5N	115.0W	230/030	242/483	-
010000Z	16.2N	114.9W	230/078	248/570	-
010600Z	16.8N	114.6W	227/106	243/534	-
011200Z	17.5N	114.4W	235/186	244/624	-
011800Z	18.0N	114.5W	237/185	224/165	-
020000Z	18.4N	114.7W	237/210	244/273	249/924
020600Z	18.8N	114.8W	239/222	231/210	-
021200Z	19.2N	114.9W	259/210	250/237	245/880
021800Z	19.6N	115.0W	066/182	242/286	-
030000Z	20.2N	115.0W	001/063	240/318	247/441
030600Z	20.8N	114.9W	052/112	240/351	-
031200Z	21.3N	114.7W	070/210	240/378	245/370
031800Z	21.7N	114.3W	063/040	062/360	-
040000Z	22.1N	114.2W	065/084	059/156	242/532
040600Z	22.5N	114.3W	001/055	058/190	-
041200Z	22.8N	114.4W	302/015	-	242/612
041800Z	23.2N	114.7W	080/078	068/303	-
050000Z	23.6N	115.0W	074/138	073/312	065/366

FORECAST ERROR: 24 HR = 146.0 MI
(DUE TO UNUSUAL 48 HR = 338.2 MI
MOVEMENT OF 72 HR = 585.0 MI
STORM, ERRORS ARE GROSS)

EYE FIXES TROPICAL CYCLONE #14 (HURRICANE MONICA)

NO.	TIME	POSIT	ACC.	FLT LVL	SFC WND	EYE	DIAM
1	30 AUG	SEARCH FROM 12.5N 117.5W to 14.5N 116.5W REVEALED NOTHING					
2	312255Z	16.0N 115.0W	1 NM	500 MB	MISG	C	12 NM
3	011800Z	18.0N 114.5W	5 NM	500/700MB	50 KTS	C	50 NM
4	021624Z	19.5N 115.0W	2 NM	500/700MB	75 KTS	C	40 NM
5	021955Z	19.7N 115.2W	2 NM	500/700MB	65 KTS	C	40 NM
6	031550Z	21.4N 114.4W	5 NM	700 MB	40 KTS	C	30 NM- NO WALL CLD
7	031950Z	21.8N 114.3W	5 NM	700 MB	35 KTS	C	30 NM- NO WALL CLD
8	041609Z	23.1N 114.7W	5 NM	700 MB	25 KTS	C	45 NM- NO WALL CLD

HURRICANE NANETTE

051800Z SEP TO 091800Z SEP 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 17
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 5
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1200 MI.

B. CHARACTERISTICS

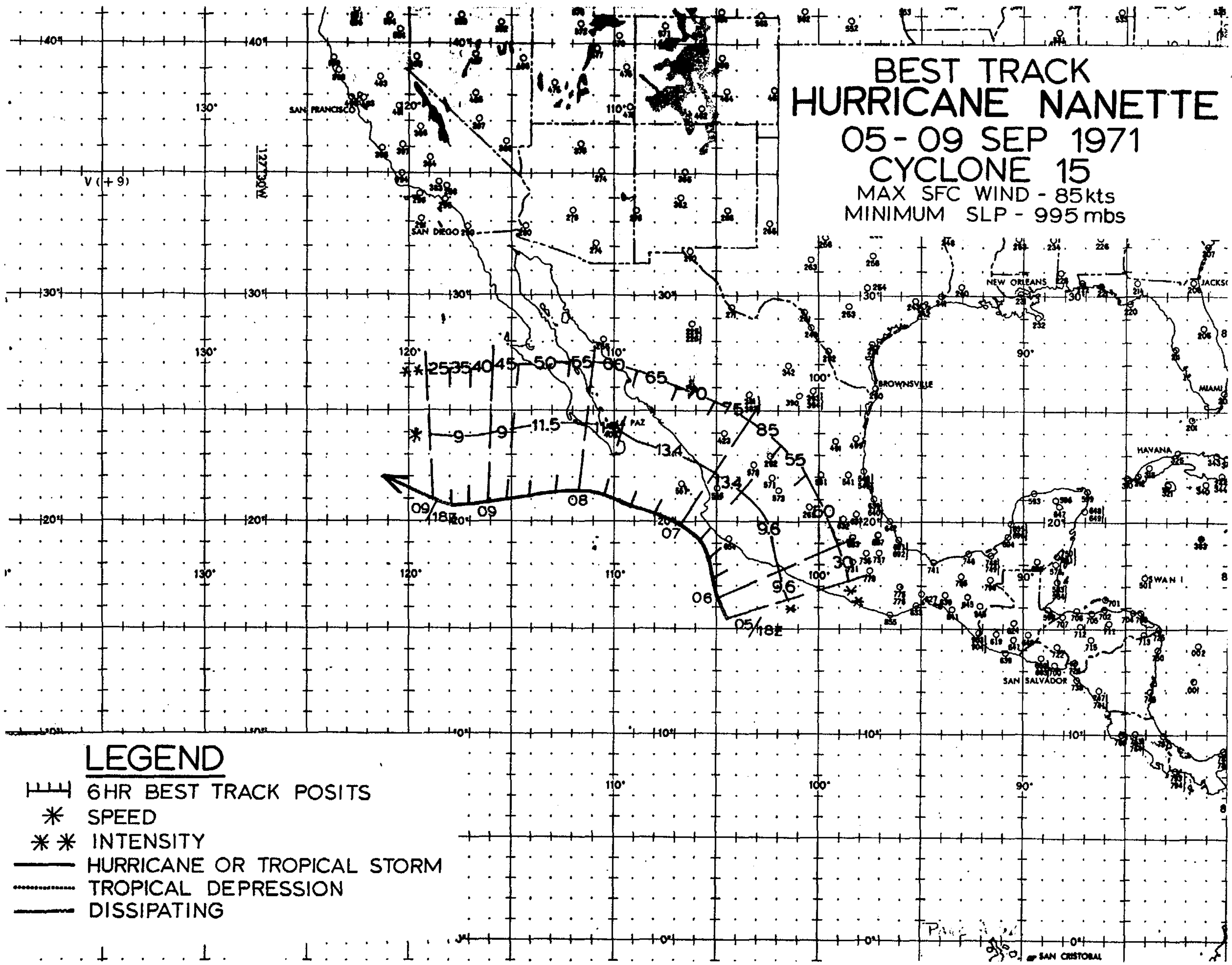
1. MINIMUM OBSERVED SLP- 995 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 85 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 051800Z
C. TIME STORM REACHED HURRICANE INTENSITY - 061800Z

III. FINAL DISPOSITION

A. DISSIPATED OVER WATER NEAR 21.0N 119.0W



BEST TRACK
HURRICANE NANETTE
05-09 SEP 1971
CYCLONE 15
MAX SFC WIND - 85kts
MINIMUM SLP - 995 mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
SAN FRANCISCO
SAN DIEGO
NEW ORLEANS
BROWNSVILLE
HAVANA
MIAMI
SAN SALVADOR
SAN CRISTOBAL

HURRICANE NANETTE 051800Z-091800Z SEP 1971

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
051800Z	15.5N	104.5W	-	-	-
060000Z	16.3N	104.9W	-	-	-
060600Z	17.3N	105.1W	-	-	-
061200Z	18.3N	105.3W	-	-	-
061800Z	19.1N	105.8W	192/201	-	-
070000Z	19.9N	106.8W	165/120	-	-
070600Z	20.4N	108.0W	149/147	-	-
071200Z	20.8N	109.2W	138/175	-	-
071800Z	21.2N	110.6W	115/175	-	-
080000Z	21.3N	111.7W	063/210	121/265	-
080600Z	21.2N	112.9W	044/285	114/295	-
081200Z	21.1N	114.1W	044/368	105/321	-
081800Z	21.0N	115.2W	015/177	085/333	-
090000Z	20.9N	116.1W	360/275	268/452	090/393
090600Z	20.8N	117.0W	006/360	054/618	-
091200Z	20.8N	117.9W	010/218	-	089/459
091800Z	21.0N	118.7W	154/126	200/252	-

FORECAST ERROR: 24 HR ERROR = 218.0 NM
48 HR ERROR = 362.0 NM
72 HR ERROR = 426.0 NM

EYE FIXES TROPICAL CYCLONE #15 (AND 16) (HURRICANE NANETTE)

NO.	TIME	POSIT		ACC.	FLT LVL	SFC WND	EYE	DIAMETER
1	061900Z	19.3N	106.1W	5 NM	700 MB	80 KTS	C	10 NM
2	062100Z	19.5N	106.5W	5 NM	700 MB	85 KTS	C	8 NM
3	071825Z	21.1N	110.8W	5 NM	700 MB	65 KTS		10 NM
4	072100Z	21.5N	111.3W	5 NM	700 MB	65 KTS	C	10 NM

TROPICAL DEPRESSION #16 FIRST REPORTED AT 15.7N 99.8W at 051800Z HAD, BY 060000Z MERGED WITH T.D. #15 (NANETTE).

HURRICANE OLIVIA

201500Z SEP TO 300600Z SEP 1971

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 40
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 26
3. TOTAL DISTANCE TRAVELED IN THE PACIFIC DURING TROPICAL WARNING PERIOD - 2000 MILES

B. CHARACTERISTICS

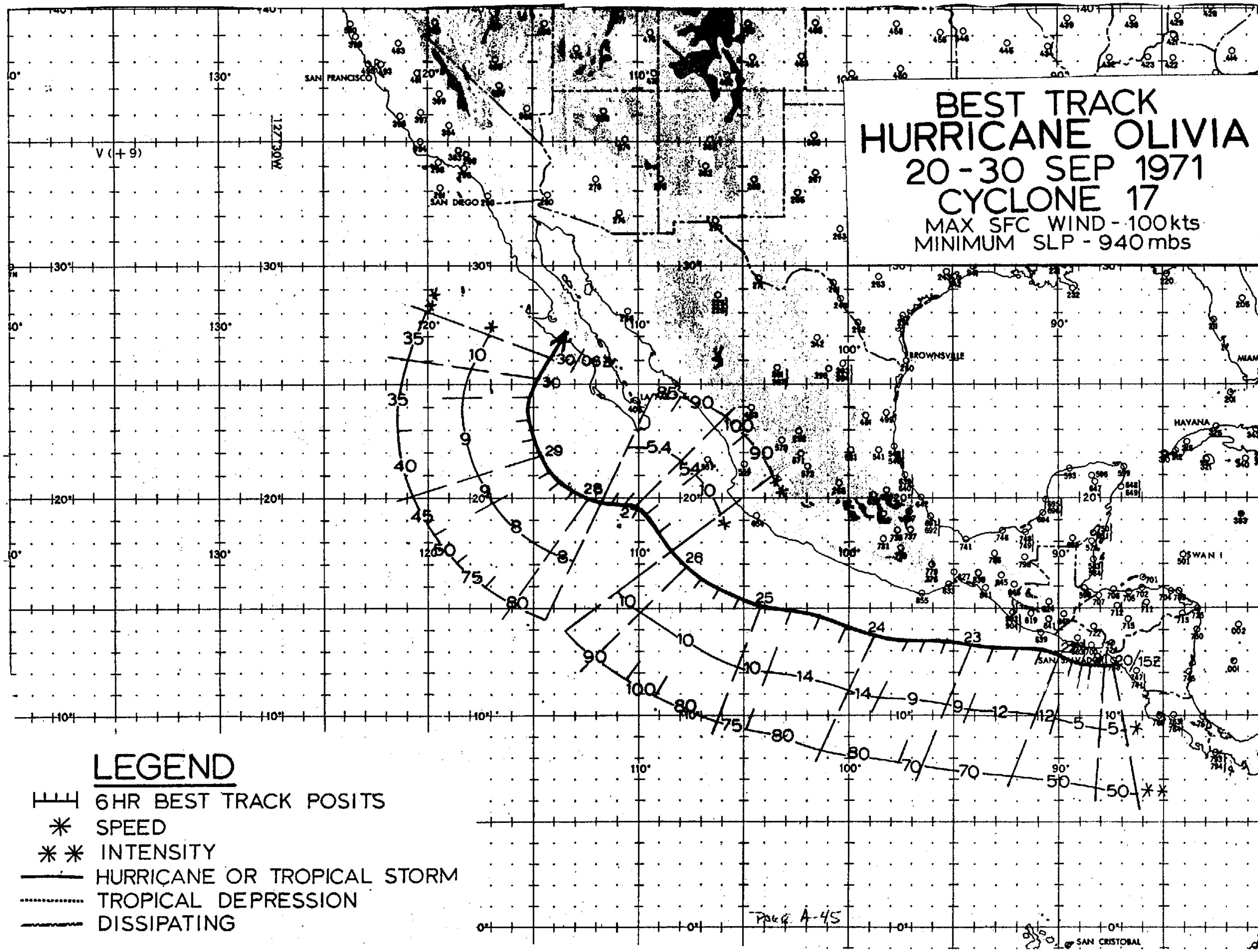
1. MINIMUM OBSERVED SLP - 940 MBS
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT REPORTED
3. MAXIMUM SURFACE WIND - 100 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 625 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - TROPICAL STORM "IRENE" FROM THE ATLANTIC, CROSSED NICARAGUA, AND REGENERATED
B. INITIAL SURFACE VORTEX, PACIFIC SIDE - 201500Z
C. TIME STORM REACHED HURRICANE INTENSITY, PACIFIC SIDE - 212100Z

III. FINAL DISPOSITION

A. MOVED ONSHORE OVER BAJA CALIFORNIA NEAR 27.0N 113.0W



BEST TRACK
HURRICANE OLIVIA
20-30 SEP 1971
CYCLONE 17
MAX SFC WIND - 100kts
MINIMUM SLP - 940mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
SAN FRANCISCO
SAN DIEGO
BROWNSVILLE
HAVANA
SWAN I
SAN CRISTOBAL
20/15Z
30/06Z
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HURRICANE OLIVIA (IRENE) 201500Z - 300600Z SEPT 1971

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
201500Z	12.3N	87.5W	-	-	-
201800Z	12.3N	87.8W	-	-	-
210000Z	12.4N	88.4W	-	-	-
210600Z	12.5N	88.9W	-	-	-
211200Z	12.7N	89.4W	-	-	-
211800Z	12.9N	89.9W	261/084	-	-
220000Z	13.1N	90.9W	260/055	-	-
220600Z	13.1N	92.0W	284/037	-	-
221200Z	13.1N	93.1W	280/030	-	-
221800Z	13.2N	94.2W	180/006	350/030	-
230000Z	13.4N	95.3W	072/038	090/018	-
230600Z	13.5N	96.2W	023/045	090/029	-
231200Z	13.5N	97.1W	007/065	040/037	-
231800Z	13.5N	98.0W	011/090	070/049	-
240000Z	13.7N	98.9W	324/054	070/064	076/050
240600Z	14.1N	100.2W	318/090	041/073	-
241200Z	14.5N	101.5W	295/066	039/085	073/105
241800Z	14.9N	102.8W	112/088	048/128	-
250000Z	15.1N	104.2W	093/114	077/087	099/188
250600Z	15.5N	105.2W	095/132	006/121	-
251200Z	15.9N	106.1W	093/144	086/092	065/126
251800Z	16.3N	107.0W	050/148	097/181	-
260000Z	16.9N	107.8W	043/250	086/168	068/135
260600Z	17.6N	108.5W	-	088/191	-
261200Z	18.5N	109.0W	026/201	085/212	070/255
261800Z	19.3N	109.6W	007/040	081/277	-
270000Z	19.7N	110.2W	043/203	-	082/315
270600Z	19.8N	110.7W	025/111	-	-
271200Z	19.8N	111.2W	031/230	-	084/373
271800Z	19.8N	111.8W	037/180	-	-
280000Z	20.0N	112.3W	030/207	-	-
280600Z	20.2N	113.1W	038/280	055/366	-
281200Z	20.6N	113.8W	011/170	052/522	-
281800Z	21.1N	114.3W	151/033	057/426	-
290000Z	21.9N	114.7W	164/057	060/412	-
290600Z	22.7N	115.0W	180/088	-	-
291200Z	23.6N	115.2W	200/138	357/144	-
291800Z	24.5N	115.1W	189/193	200/195	-
300000Z	25.3N	114.7W	260/150	204/165	-
300600Z	26.1N	114.1W	280/123	219/285	-

FORECAST ERROR: 24 HR ERROR = 115.8NM
48 HR ERROR = 174.3NM
72 HR ERROR = 193.3NM

EYE FIXES HURRICANE OLIVIA

NO.	TIME	POSIT	ACC.	FLT LVL	SFC WNDS	EYE	DIAMETER
1	212122Z	13.0N 90.2W	10MI	700MB	70 KTS	C	20 MI
2	222120Z	13.3N 94.9W	15MI	700MB	70 KTS	C	20 MI
3	232216Z	13.6N 98.5W	10MI	700MB	80 KTS	E	08/25/10
4	242349Z	15.1N 104.2W	10MI	700MB	misg	C	15 MI
5	261800Z	19.3N 109.6W	5MI	700MB	100 KTS	C	17 MI
6	262200Z	19.6N 110.0W	5MI	700MB	90 KTS	C	13 MI
7	272000Z	19.8N 112.0W	5MI	700MB	80 KTS	C	18 MI
8	280000Z	20.0N 112.3W	5MI	700MB	80 KTS	E	04/15/8

HURRICANE PRISCILLA

061200Z OCT TO 121800Z OCT 1971

DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 26
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 14
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1500 MILES

B. CHARACTERISTICS

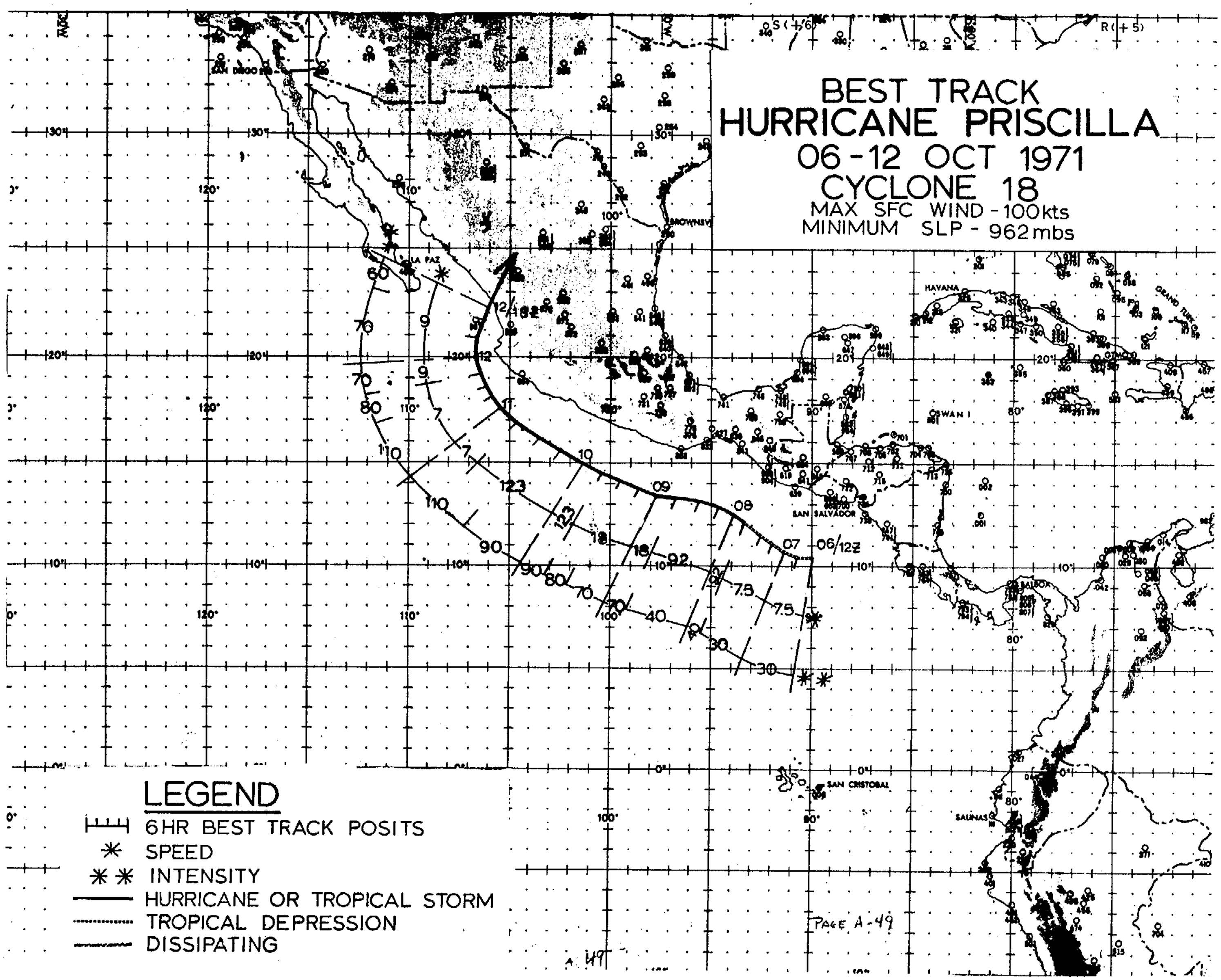
1. MINIMUM OBSERVED SLP - 962 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 110 KNOTS
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MILES

II. DEVELOPMENT

A. INITIAL IMPETUS - ITCZ
B. INITIAL SURFACE VORTEX - 061200Z
C. TIME STORM REACHED HURRICANE INTENSITY - 081800Z

III. FINAL DISPOSITION

A. DISSIPATED OVER THE MOUNTAINS OF MEXICO NEAR 23.0N 104.0W


BEST TRACK
HURRICANE PRISCILLA
06 - 12 OCT 1971
CYCLONE 18
MAX SFC WIND - 100kts
MINIMUM SLP - 962mbs
LEGEND
6HR BEST TRACK POSITS
SPEED
INTENSITY
HURRICANE OR TROPICAL STORM
TROPICAL DEPRESSION
DISSIPATING
PAGE A-49

061200Z-121800Z OCT 1971

HURRICANE PRISCILLA

TIME	STORM POSIT LAT	LONG	24 HR ERROR DEG/DIST	48 HR ERROR DEG/DIST	72 HR ERROR DEG/DIST
061200Z	10.5N	90.0W	-	-	-
061800Z	10.5N	90.7W	-	-	-
070000Z	10.7N	91.4W	-	-	-
070600Z	11.1N	92.0W	-	-	-
071200Z	11.6N	92.6W	223/051	-	-
071800Z	12.2N	93.3W	215/074	-	-
080000Z	12.6N	93.9W	211/092	-	-
080600Z	12.9N	94.7W	210/097	-	-
081200Z	13.1N	95.7W	220/030	-	-
081800Z	13.1N	96.8W	320/008	-	-
090000Z	13.3N	97.8W	063/027	-	-
090600Z	13.7N	98.7W	145/065	-	-
091200Z	14.1N	99.6W	090/042	-	-
091800Z	14.6N	100.4W	125/030	125/030	-
100000Z	15.0N	101.4W	230/062	120/063	-
100600Z	15.6N	102.5W	135/065	116/095	-
101200Z	16.2N	103.6W	137/096	123/113	-
101800Z	16.9N	104.8W	143/069	133/144	-
110000Z	17.6N	105.4W	170/075	138/168	133/162
110600Z	18.1N	105.8W	195/093	152/141	-
111200Z	18.6N	106.1W	210/109	158/111	147/148
111800Z	19.2N	106.4W	312/074	218/074	-
120000Z	20.0N	106.8W	360/096	222/198	168/190
120600Z	20.9N	106.7W	032/114	237/233	-
121200Z	21.7N	106.1W	-	223/218	206/226
121800Z	22.3N	105.0W	-	-	-

FORECAST ERROR: 24 = 68.5 MILES
48 = 132.3 MILES
72 = 181.5 MILES

EYE FIXES HURRICANE "PRISCILLA"

NO.	TIME	POSIT	ACC	FLT LVL	SFC WNDS	EYE	DIAMETER
1	081734Z	13.1N 96.8W	4 NM	700MB	50 KTS	C	40 MILES
2	091740Z	14.6N 100.4W	5 NM	700MB	75 KTS	C	11 MILES
3	101800Z	16.9N 104.8W	5 NM	700MB	110 KTS	C	20 MILES
4	111750Z	19.2N 106.4W	15 NM	700MB	80 KTS	C	20 MILES

ANNEX

B

CYCLONE STATISTICS AND BEST TRACKS

IN THE BAY OF BENGAL

FOR

1971

SUMMARY OF BAY OF BENGAL
TROPICAL CYCLONES (>34 KT) 1971

	TC 25-71	TC 27-71
TOTAL NUMBER OF WARNINGS	5	5
CALENDAR DAYS OF WARNING	2	2
DISTANCE TRAVELED DURING WARNING PERIOD	458 N MI	663 N MI
MAXIMUM WINDS	100 KT	70 KT

Tropical cyclones in the Bay of Bengal are numbered consecutively from the beginning of the calendar year and are included with those developing in the South Pacific and Indian oceans.

The JTWC area of resposibility in the Bay of Bengal was expanded on 4 June 1971 to include the area north of the equator between the Malay Peninsula and 90E. Only those cyclones that developed or tracked through this area are included in Annex B.

CYCLONE 25-71
271200Z OCT TO 300000Z OCT

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 5
2. NUMBER OF WARNINGS WITH CYCLONE INTENSITY - 2
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 458 N MI

B. CHARACTERISTICS

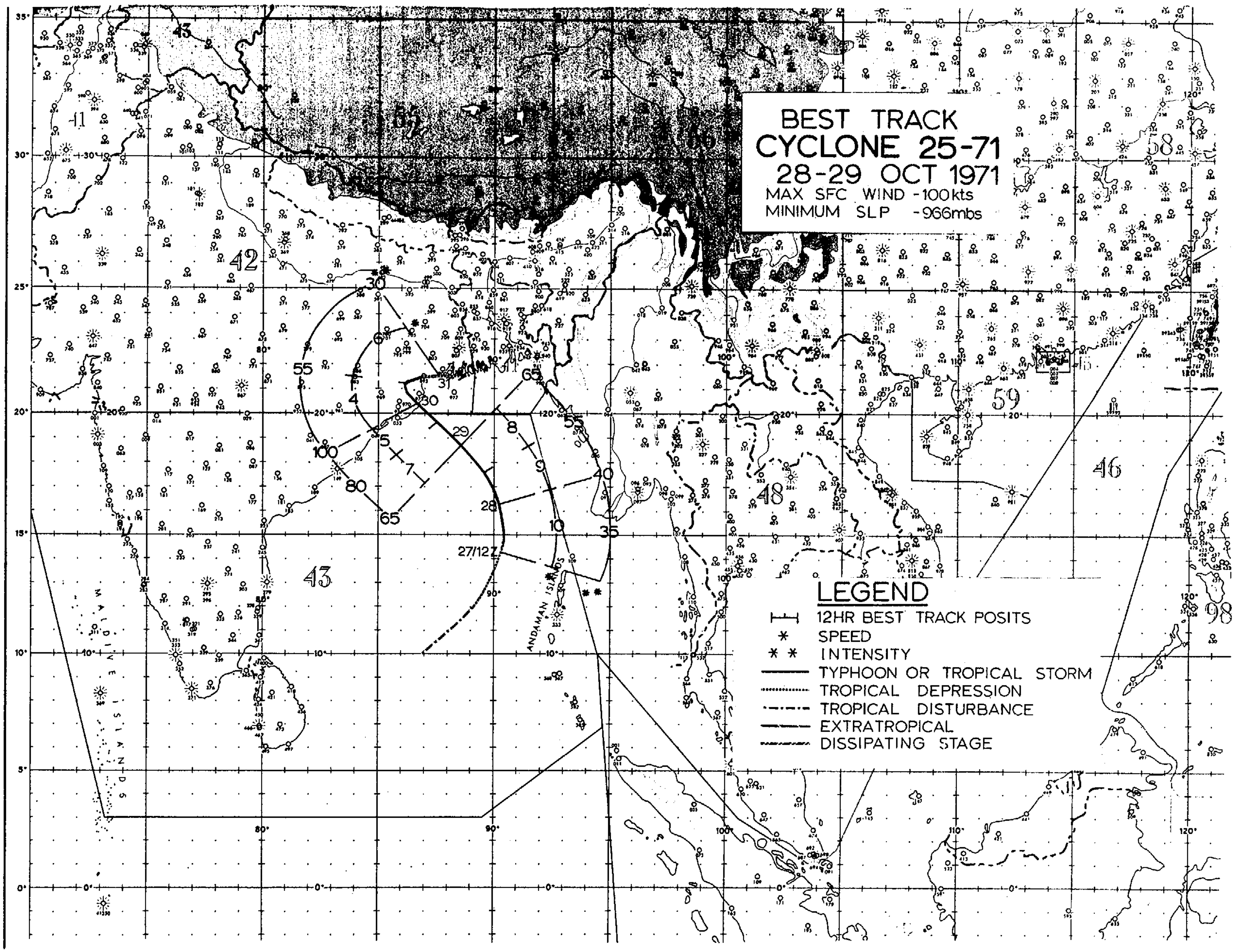
1. MINIMUM OBSERVED SLP - 966 MB
2. MINIMUM OBSERVED 700 MB HEIGHT - 2935 M
3. MAXIMUM SURFACE WIND - 100 KT
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - N/A

II. DEVELOPMENT

A. INITIAL IMPETUS - 25 OCT 1971
B. INITIAL SURFACE VORTEX - 26 OCT 1971
C. DATE STORM REACHED CYCLONE FORCE WINDS - 29 OCT 1971

III. FINAL DISPOSITION

A. DISSIPATED OVER LAND


BEST TRACK
CYCLONE 25-71
28-29 OCT 1971
MAX SFC WIND -100kts
MINIMUM SLP -966mbs
LEGEND
12HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
ANDAMAN ISLANDS
MALDIVE ISLANDS
27/12Z

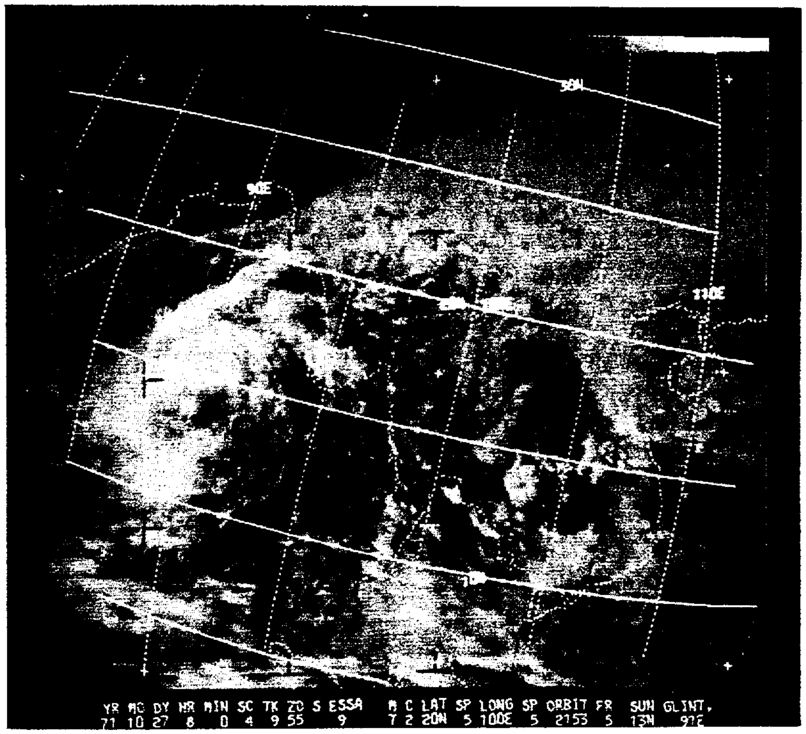


FIGURE B-1. ESSA-9 PHOTO OF THE FORMATIVE STAGES OF CYCLONE 25-71 IN THE BAY OF BENGAL ON 27 OCTOBER.

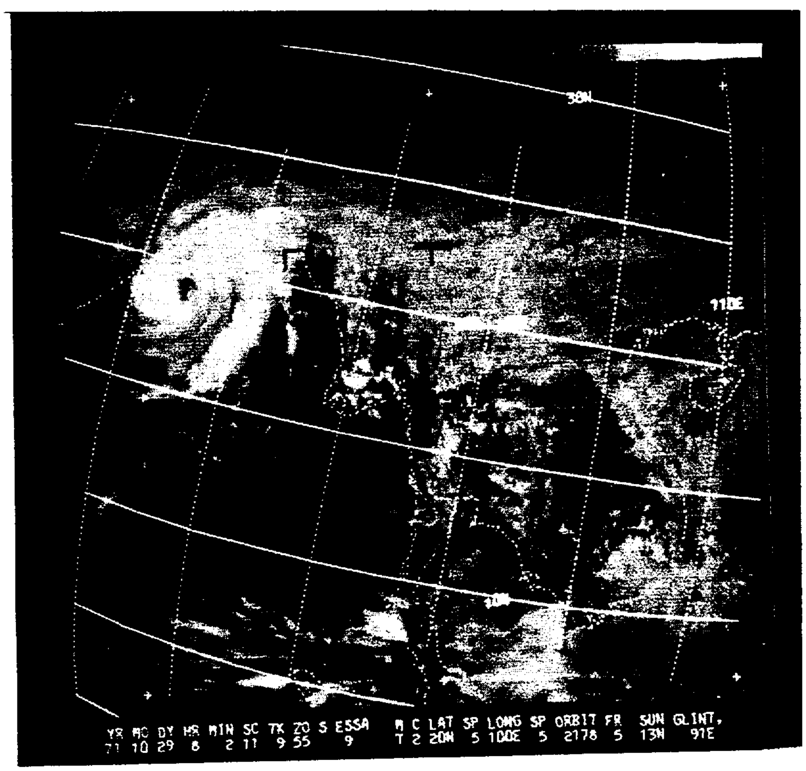


FIGURE B-2. CYCLONE 25-71 AS VIEWED BY ESSA-9 ON 29 OCTOBER BEFORE STRIKING THE INDIAN COAST NEAR CUTTACK.

EYE FIXES FOR TROPICAL CYCLONE 25-71
28 OCT - 29 OCT 71

FIX NO.	TIME	POSIT	UNIT - METHOD - ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700 MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS
1	260352Z	10.5N 87.6E	SATELLITE	WEAK CIRCULATION		----	----	------	-----	----	------	---	----	ESSA-8 DIEGO GARCIA IS.
2	270800Z	13.0N 90.0E	SATELLITE	STG B	-------	----	----	------	-----	----	------	---	----	FIRST BULLETIN
3	280245Z	16.6N 90.0E	54-P-10-15	700	40	40		3075	-----	----	------	40	----	NO RADAR PRESENTATION
4	280859Z	17.5N 90.0E	SATELLITE	STG X	DIA 3.5	CAT 2	----	------	-----	----	------	---	----	ESSA-9
5	290300Z	18.8N 87.0E	54-P-----	700	-------	50	----	------	-----	----	------	---	----	PRELIMINARY FIX
6	290530Z	19.2N 87.9E	54-P-02-05	700	65	50	989	2935	12/10	CIRC	------	30	----	WALL CLD POORLY DEF
7	290802Z	19.0N 87.3E	SATELLITE	STG X	DIA 2.5	CAT 3	----	------	-----	----	------	---	----	ESSA-9

POSITION FROM BEST TRACK AND VERIFICATION DATA
25-71 BAY OF BENGAL

	STORM POSIT		24HR ERROR	48HR ERROR
TIME	LAT	LONG	DEG/DIST	DEG/DIST
280000Z	16.2N	90.2E		
281200Z	17.8N	89.5E		
290000Z	18.9N	88.4E	087°/107 MI	
291200Z	19.7N	87.4E	077°/181 MI	
300000Z	20.7N	86.8E	105°/128 MI	076°/244 MI

AVG 24 HOUR FORECAST ERROR - 139 MI

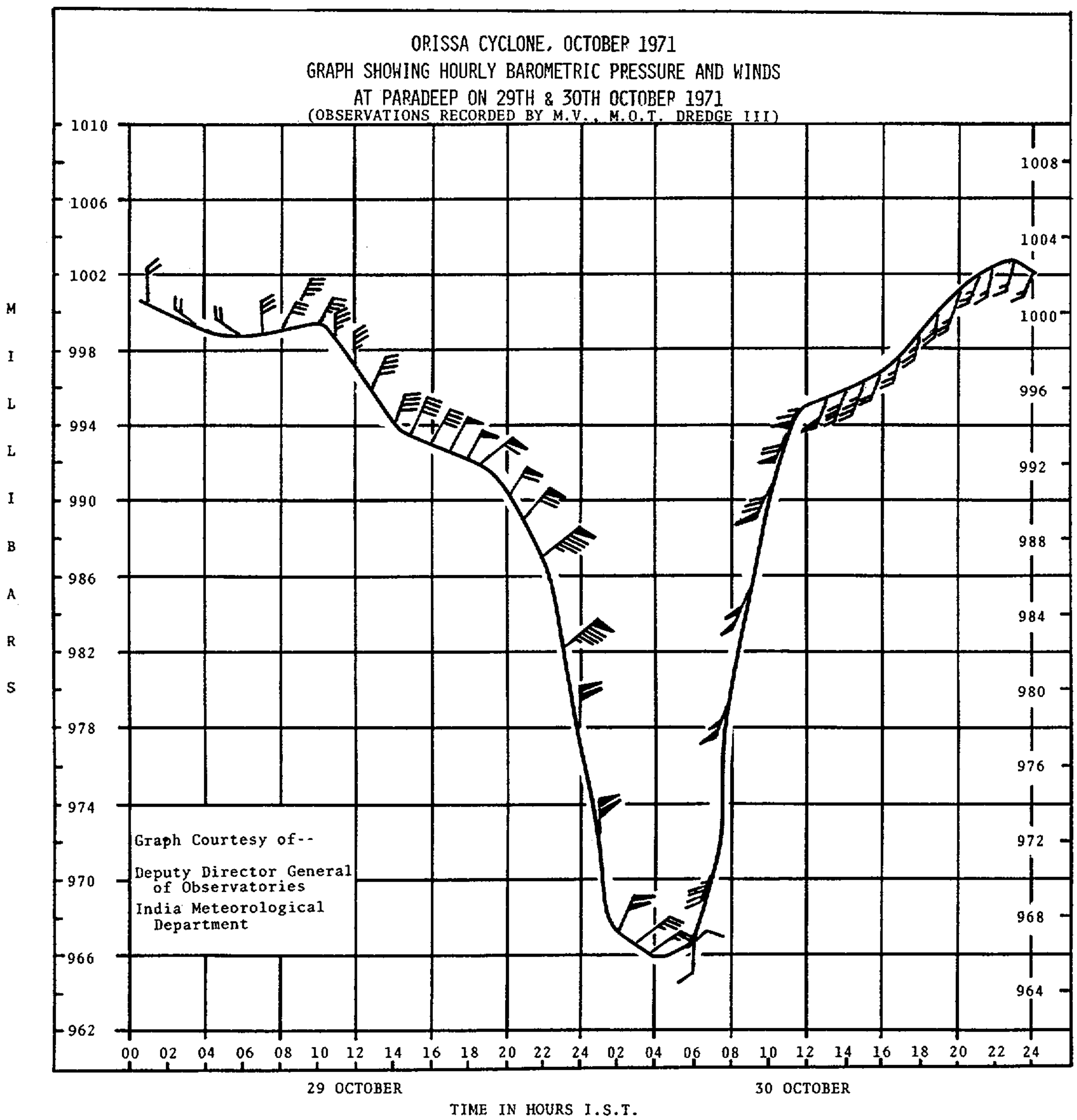


FIGURE B-2a

CYCLONE 27-71
041200Z NOV TO 061200Z NOV

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 5
2. NUMBER OF WARNINGS WITH CYCLONE INTENSITY - 2
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 663 N MI

B. CHARACTERISTICS

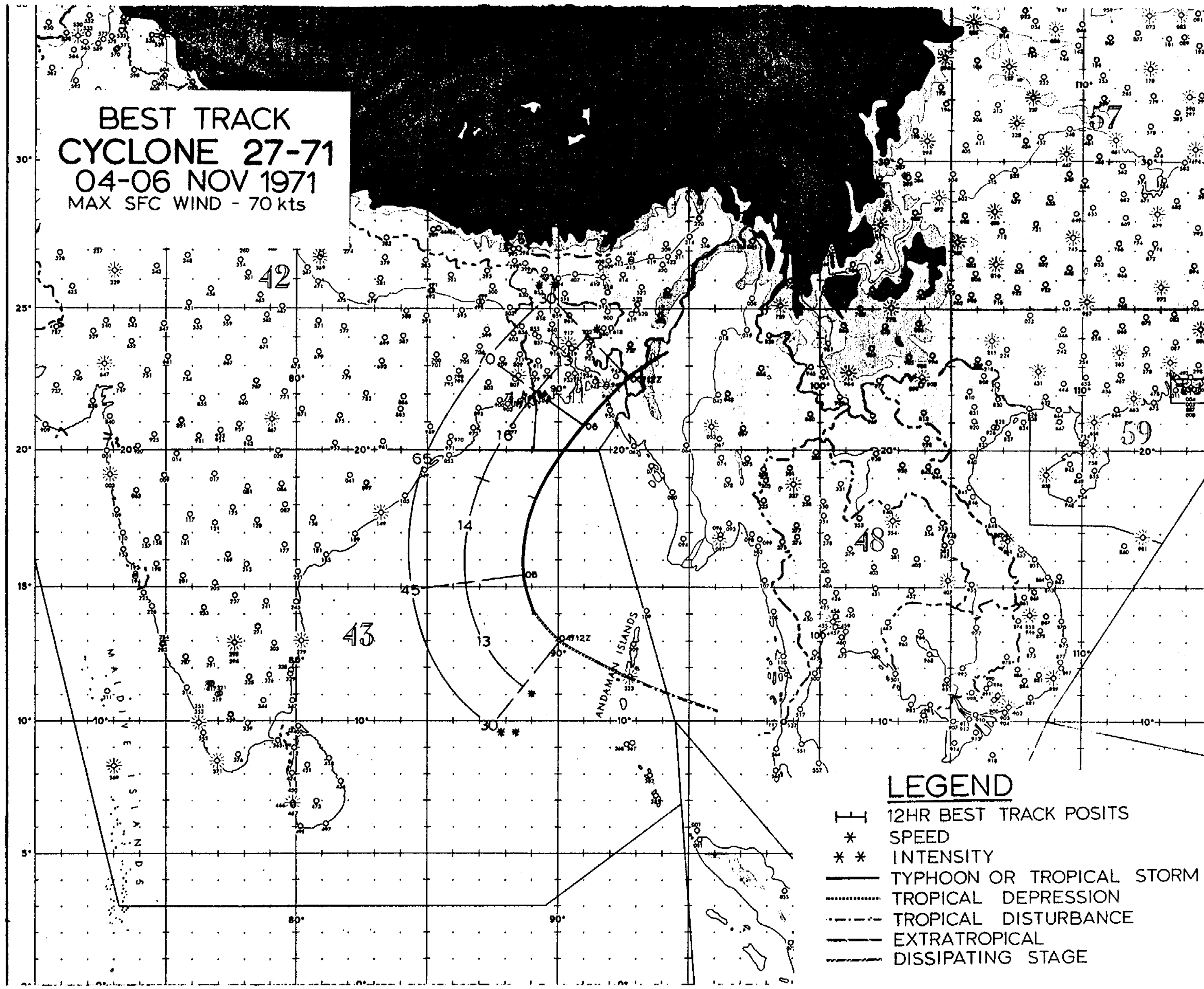
1. MINIMUM OBSERVED SLP - N/A
2. MINIMUM OBSERVED 700 MB HEIGHT - 3018 M
3. MAXIMUM SURFACE WIND - 70 KT
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - N/A

II. DEVELOPMENT

A. INITIAL IMPETUS - N/A
B. INITIAL SURFACE VORTEX - 04 NOV 1971
C. DATE STORM REACHED CYCLONE FORCE WINDS - 06 NOV 1971

III. FINAL DISPOSITION

A. DISSIPATED OVER LAND


BEST TRACK
CYCLONE 27-71
04-06 NOV 1971
MAX SFC WIND - 70 kts
LEGEND
12HR BEST TRACK POSITS
SPEED
INTENSITY
TYPHOON OR TROPICAL STORM
TROPICAL DEPRESSION
TROPICAL DISTURBANCE
EXTRATROPICAL
DISSIPATING STAGE
MALDIVE ISLANDS
ANDAMAN ISLANDS

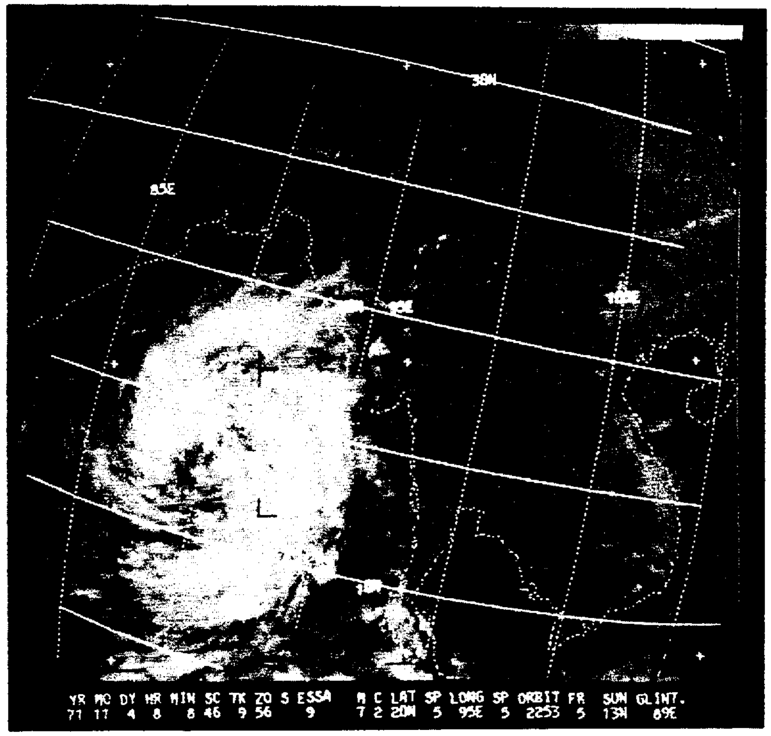


FIGURE B-3. ESSA-9 PHOTOGRAPHS CYCLONE 27-71 IN THE CENTRAL BAY OF BENGAL ON 4 NOVEMBER.

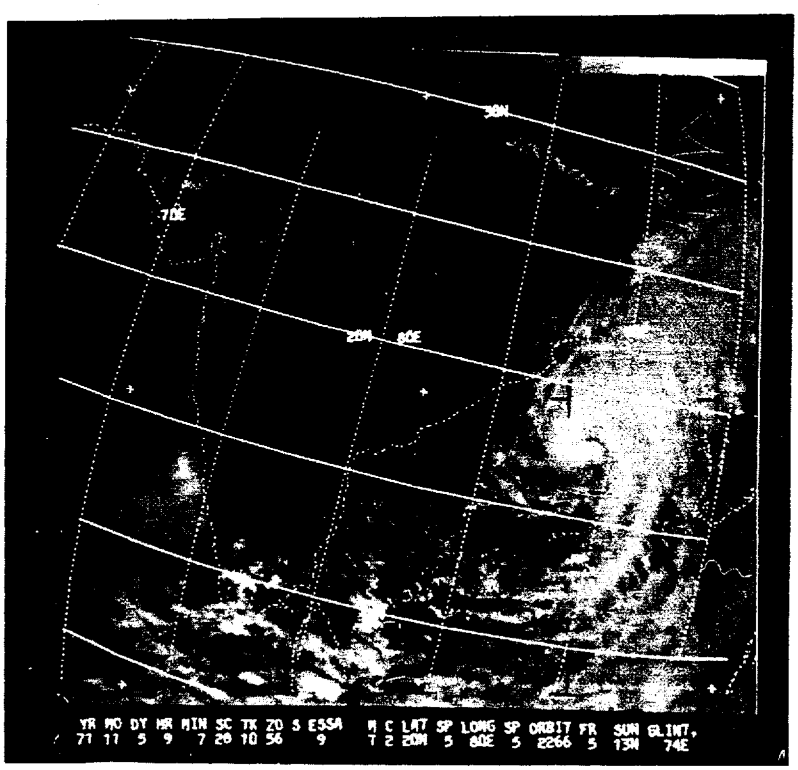


FIGURE B-4. CYCLONE 27-71 PRIOR TO RECURVATURE AS VIEWED BY ESSA-9 ON 5 NOVEMBER.

EYE FIXES FOR TROPICAL CYCLONE 27-71
04 NOV - 06 NOV 71

FIX NO.	TIME	POSIT	UNIT - METHOD - ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700 MB HGT	FLT LVL TI/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKN WALL CLD	REMARKS
1	030910Z	11.5N 95.0E	SATELLITE	STG B	-------	-----	----	------	-----	----	------	---	----	ESSA-9
2	040809Z	13.5N 89.5E	SATELLITE	STG C+	-------	-----	----	------	-----	----	------	---	----	ESSA-9
3	050907Z	18.1N 89.5E	SATELLITE	STG X	DIA 6	CAT 2	----	------	-----	----	------	---	----	ESSA-9
4	051230Z	18.3N 89.4E	54-P-----	700	75	-----	----	------	-----	----	------	---	----	40 NM DIA WIND CENTER
5	051430Z	18.9N 89.5E	54-P-05-15	700	70	-----	----	3018	14/11	----	------	---	----	NO WALL CLD
6	060230Z	21.4N 91.4E	54-R-15-20	700	55	70	----	------	-----	CIRC	------	25	----	WEAK-MDT WALL CLD

POSITION FROM BEST TRACK AND VERIFICATION DATA
27-71 BAY OF BENGAL

TIME	STORM POSIT LAT	STORM POSIT LONG	24HR ERROR DEG/DIST	48HR ERROR DEG/DIST
041200Z	13.0N	90.0E		
050000Z	15.4N	88.8E		
050700Z	16.9N	88.9E		
051200Z	18.1N	89.2E	224°/282 MI	
060000Z	20.9N	90.0E	232°/415 MI	
060700Z	21.9N	91.9E	230°/250 MI	
061200Z	22.6N	92.8E	175°/258 MI	238°/576 MI

AVG 24 HOUR FORECAST ERROR - 301 MI

APPENDIX

ABBREVIATIONS AND DEFINITIONS

The following abbreviations and definitions apply for the purposes of this report.

1. ABBREVIATIONS

AJTWC	Alternate Joint Typhoon Warning Center (Asian Weather Central, Fuchu, Japan)
APT	Automatic Picture Transmission
ATS	Applications Technology Satellite
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Forces
CINCPACFLT	Commander in Chief, Pacific Fleet
DRIR	Direct Readout Infrared Radiometer
EPRF	Environmental Prediction Research Facility (Naval Postgraduate School, Monterey, California)
MPT	Mid-Pacific Trough
NEDN	Naval Environmental Data Network
NESS	National Environmental Satellite Service (Suitland, Maryland)
NWS/NOAA	National Weather Service, National Oceanic and Atmospheric Administration
PACOM	Pacific Command
SLP (MSLP)	Sea Level Pressure (Minimum Sea Level Pressure)
TCRC	Tropical Cyclone Reconnaissance Coordinator

2. DEFINITIONS

<u>CYCLONE</u> - An atmospheric closed circulation, rotating counterclockwise in the Northern Hemisphere.

TROPICAL CYCLONE - A non-frontal cyclone of synoptic scale, developing over tropical or sub-tropical waters and having a definite organized circulation and warm core.

TROPICAL DEPRESSION - A tropical cyclone in which the maximum sustained surface wind is 33 kt or less.

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds in the range 34 to 63 kt inclusive.

TYPHOON/HURRICANE - A tropical cyclone with maximum sustained surface wind speeds 64 kt or greater. West of 180 degrees longitude the name TYPHOON is used and east of 180 degrees longitude the name HURRICANE is used. All descriptive references to typhoons apply equally to hurricanes.

SUPER TYPHOON - A typhoon with maximum sustained winds greater than or equal to 130 kt.

TROPICAL DISTURBANCE - A discrete system of apparently organized convection, generally 100 to 300 miles in diameter originating in the tropics or sub-tropics, having a non-frontal migratory character and having maintained its identity for 24 hours or more. It may or may not be associated with a detectable perturbation on the wind field. As such, it is the basic generic designation which, in successive stages of intensification, may be subsequently classified as a tropical depression, tropical storm or typhoon.

EYE/CENTER - EYE refers to the roughly circular central area of a well-developed tropical cyclone usually characterized by comparatively light winds and fair weather. If more than half surrounded by wall cloud, the word EYE is used; otherwise, the area is referred to as a CENTER.

WALL CLOUD - A densely organized, roughly circular structure of cumuliform clouds completely or partially surrounding the eye or center of a tropical cyclone.

MAXIMUM SUSTAINED WIND - Highest surface wind speed of a cyclone averaged over a one minute period of time.

EXTRATROPICAL - A term used in warnings and tropical summaries to indicate that a cyclone has lost its "tropical characteristics". The term implies both poleward displacement from the tropics and the conversion of the cyclone's dominant energy source from latent heat of condensation release to baroclinic processes.

TROPICAL CYCLONE RECONNAISSANCE COORDINATOR - A CINCPACAF representative designated to levy tropical cyclone weather reconnaissance requirements on CINCPACFLT and CINCPACAF reconnaissance units within a designated area of PACOM and to function as a coordinator between CINCPACAF, weather reconnaissance units, and JTWC.

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HQ, 1WW (20)
HQ, 9TH WEA RECON WG (2)
HQ, 1ST MARINE ACFT WG (5)
HQ, 3WW (1)
54WRS (10)
55WRS (1)
53WRS (1)
HQ, THIRD AIR DIV (8)
HQ, 315TH AIR DIV (1)
HQ, 313TH AIR DIV (1)
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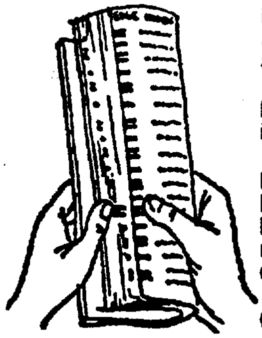
EDGE INDEX

HOW TO USE THE EDGE INDEX



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